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A New York Senator Helping His Home Port (?)

TO add to the present trials and hardships of ship repairers, Senator Copeland must needs have inserted in the bill providing appropriations for the Shipping Board, for next year, the stipulation that the navy yards shall estimate on all the board's repair work and when their figures are lower than the regular bids of legitimate shipyards, they are to be awarded the work.

This matter has often been discussed and no good can now come from a detailed statement of the need of maintaining private yards, the logic of which is unanswerable and is admitted by all fair-minded men who are at all conversant with the present shipping situation.

In the late war, the private repair plants played quite as important a part as the navy yards. Leaving aside the essential economic unsoundness underlying the system by which merchant repairs are handled in government yards, it would seem clearly within the ability of everyone, excepting the political demagogue, to grasp the fact that the ship repair yards are an industry essential to the country's commerce and, particularly in the present depression, they should be supported and not destroyed by legislation.

The shipping interests of the country demand that Senator Copeland's proposal be withdrawn.

Diesel Conversion

THE passage, by the House, of the bill authorizing the use of a portion of the Shipping Board's construction loan fund for the fitting of certain of its vessels with Diesel propelling machinery, brings the Board's program a good step nearer to actual realization. While no one can forecast what fate the bill may meet in the Senate nor whether it will even be acted upon, there seems to be little or no opposition to its enactment into law, and its eventual passage can at least be looked forward to with a considerable degree of hope.

The impression seems to prevail, in some quarters, that the ships to be fitted with Diesel engines have been chosen because of their unfitness for service. While this is literally true, it is not a fact that these vessels are in any way unfitted for the purpose in view, as their present deficiency is entirely due to defective propelling machinery, a shortcoming which the proposed conversion will eliminate.

As a matter of fact, certain of the vessels which, in the recent general survey, were reported as available for conversion to Diesel drive, have particularly good models, as indicated by their curves of effective horsepower. Unfortunately, good tank results cannot always be taken as an indication of equally satisfactory sea performances, but, in the case of the Shipping Board vessels, we believe it to be a fact that those whose model tests indicated unduly high resistance have also proved to be big fuel eaters. It is, of course, quite possible that this lack of efficiency was due quite as much to defective machinery and propellers as to underwater form, but, from an inspection of their lines, we are inclined to the belief that the model was largely responsible for the unsatisfactory results which were obtained.

In any event, there is a very considerable number of ships to choose from and it would certainly appear unwise to select for conversion any vessels whose tank curves indicate inefficient models, unless, of course, there are accurate voyage records which show conclusively that the ships in question were able to maintain a satisfactory speed at sea without undue expenditure of power.

In this connection, the problem of propeller design for single screw motorships becomes of first importance. Even the so-called slow speed Diesel engines operate, in general, at higher revolutions than do the steam engines of ordinary full-bodied cargo vessels, and it is apparent that a considerable modification of propeller design will be necessary if the new propeller of, say 16 feet diameter, running at 90 revolutions is to show as high an efficiency as one of

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perhaps 18 feet running at 75 revolutions. So far as we are aware, there is no accurate data extant as to the performance of relatively small, fast running wheels on ships having a block coefficient of 0.78 or 0.80, such as obtain in the majority of Shipping Board vessels, and while it is true that many of these ships were designed for 90 revolutions at full power, in service they ran much slower than this, and it is probable that the designed revolutions could not have been maintained at sea without a considerable loss of propulsive efficiency. Large propeller diameter seems essential for high propulsive efficiency in full-bodied ships under sea conditions, and this in turn implies low pitch ratios, if the revolutions are increased. Experience seems to indicate that there is a point in the progressive reduction of pitch ratio, beyond which the efficiency of the propeller drops rapidly. Just where this point may be has not been definitely determined, so far as we know, but it is, we believe, a fact that certain of the large emergency fleet vessels, which were fitted with low pitch wheels, showed a very unsatisfactory propulsive efficiency, under service conditions. As the models of the ships, with their resulting wake factors, cannot be changed, the existing conditions must evidently be met by a modification of propeller design.

The progress of scientific propeller design has been rapid during recent years, and the efficiency obtained with high speed turbine propellers, radically different from their predecessors, leads one to hope that efficient low pitch, large diameter wheels may be developed with equal success. It appears to us that the design of satisfactory propellers will be at least as important as any of the other factors which enter into the problem of successfully converting the Shipping Board vessels to Diesel drive.

In the report of the Central Fleet Survey Committee, which was completed last September, a group of approximately 350 vessels was cited as being undesirable for competitive service because of their unsatisfactory propelling machinery. Aside from this defect, the majority of this group of ships were considered as potentially competitive units, as they were of good design and, in most cases, in a physical condition not requiring excessive hull repairs and renewals for active service.

As the ships to be fitted with Diesel engines will presumably be taken from among this group it is of interest to note the types and sizes of ships which are included in it.

In common with a majority of the cargo-carrying vessels of the Shipping Board fleet, those under consideration are all single screw ships of very full form and relatively low speed. The expectation, on the part of certain uninformed persons, that the fitting of Diesel machinery will result in a material increase in speed has, of course, no foundation. The ships are all of an essentially low speed type and their speed cannot be increased except by the expenditure of a disproportionate amount of power. We do believe, however, that when fitted with Diesels and properly designed propellers, they will easily equal and probably improve somewhat upon their best performance under steam, an opinion which seems to be sustained by the performance of the ships which have already been converted to Diesel drive by private parties. This superior sea performance of the motorship is undoubtedly due to two facts which have been previously mentioned in these columns, first, that the fuel supply of a Diesel is fixed and not dependent upon man power, as in the coal burning steamer, and second, that the governor control, when racing, is instantaneous, on all cylinders, and the speed, in a rough sea, is consequently maintained at a higher level than is possible with a steam engine.

In the matter of size, this group of vessels covers an approximate range of from 5,000 to 9,500 deadweight tons and, in addition, a few of the small lake-built steamers placed in this class because of their unsatisfactory boilers.

There are over one hundred vessels of from 5,100 to 5,300 tons deadweight which were built by the Submarine Boat Corporation. Report had been made of structural weakness in these ships but a careful examination of several of them revealed no indication of it and only a few minor structural defects, very easily remedied. They are, moreover, of a particularly good model and drive easily. By far the larger part of the vessels available for conversion range from 8,500 to 9,500 tons deadweight. They are, in general, of good design and many of their counterparts, fitted with efficient machinery and boilers, are giving excellent results in service. We can see no reason why they should not prove very satisfactory motorships. Certain of the 8,500-ton vessels have reciprocating engines and their shafts may be of sufficient size to be driven by Diesel engines. In the case of the turbine driven ships, however, shafts of greater diameter will undoubtedly be necessary.

From an engineering standpoint it appears that the available Shipping Board fleet should yield a large number of satisfactory motorships. The problems involved present no great difficulties, outside of the production of efficient propellers, and this latter question, judging from the performance of the *Seekonk* and other recently converted vessels, seems in a fair way of being satisfactorily solved.

The financial aspects of the problem are much more difficult to deal with. The bill now before Congress fixes the minimum hull price of the ships which may be converted by the Board at $10 per deadweight ton. This would seem to fix the cost of the complete, converted vessel at from $55 to $60 a ton. Shipowners vary widely in their views as to what they can afford to pay for increased economy. There are some who feel that a motorship at the price mentioned is a good investment, regardless of present trade conditions; others, possibly a majority, are in doubt, while a few "cannot see it at all," unless the cost of the motorship is brought down nearer to that of the steamer, but even the most pessimistic admit that the motorship will eventually displace the steamer in many, if not in all, lines of trade.

Having in mind the very extensive field, wherein the motorship has already made good and its inherent advantages over the steamer have been practically demonstrated, it would appear that the opportunity to obtain these vessels, at what is likely to prove the minimum price for a long time to come, cannot be passed by without very serious consideration on the part of all those who are engaged in the shipping business, and who propose to continue in it, in the future. What, for instance, will be the relative values of a five year old steamer and a new motorship, five years from now, when, very possibly, no cargo steamers will be built? If freight rates should drop to the level of motorship operation, what becomes of the ten year old steamer?

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The largest part of the differential against American vessels lies in their greater capital charges as compared with foreign ships. With virtually new motorships at $55 to $60 a ton, this item is very largely neutralized and the possibility of successful competitive operation becomes much more promising than anything likely to result from other means of shipping promotion at present under consideration.

So far we have been concerned with the conversion problem as it affects private owners, but there is another and most important side to be considered. Present conditions seem to make necessary the operation of a considerable number of vessels by the Shipping Board, if American ships are to continue in foreign service. This being so, it is incumbent upon the Board to maintain its fleet at the highest possible efficiency, equal, at least, to that of the foreign ships with which it is called upon to compete. This can only be done by the addition of motorships, thus meeting the rapidly increasing number of these vessels in the possession of foreign shipping companies.

From every point of view, the present bill, if enacted, seems likely to have a far reaching effect upon the future of American shipping and will undoubtedly produce constructive results of great value to the country as a whole.

American Steamboats

THE development of the distinctive American "steamboat" type of vessel is an interesting study to anyone concerned with marine affairs. Commencing almost with the first application of steam to the propulsion of ships, the vessels built for the navigation of the inland and protected waterways of this country were of a character quite different from those produced elsewhere and so well did these early steamers fulfil the peculiar requirements of the service for which they were intended that the general type of construction and design employed in them has, to a great extent, survived to the present day.

Foreign built vessels for river and bay service have generally followed, pretty closely, the seagoing type or steamship. This has been mainly due to the fact that in Europe even small vessels employed on short runs are more or less exposed to heavy sea conditions, and extended guards and light, towering upperworks cannot be adopted with safety.

In America, on the other hand, there are long stretches of well protected waters and large rivers upon which an enormous traffic is carried and the greatly increased accommodation for deck freight and for passengers which guards and tiers of deck houses give can be taken advantage of without fear of reduced seaworthiness.

The shallow wooden hulls of the early river and sound steamers, with their hog-frames to hold the flexible hull in line and with guards extending out on either side a distance approximately equal to half the width of the hull proper, in many cases, carrying the boilers, were marvels of mechanical construction, and the fact that some of these vessels, after over fifty years of service, are still in use, speaks well for the character of the materials and workmanship entering into their construction and the ingenuity and skill of their designers.

The adoption of iron and steel in hull construction did away, to a great extent, with the use of hog-frames and trusses, but the guards still remain, although, with the substitution of propellers for paddlewheels, their width has been reduced. So far as the deck houses and passenger accommodations are concerned, they have not greatly changed in general character from those of the earlier vessels.

Steamboat machinery has naturally undergone a greater change than has taken place in the hulls. In the earlier days, fuel economy was not of such vital importance and the low pressure beam engines, with their large clearances and great flexibility, were admirably adapted to the shallow and limber wooden hulls. With increased steam pressures came higher revolutions, the substitution of feathering for the old radial paddle wheels, and inclined compound or triple expansion engines. Of late years paddle wheels have largely given way to screw propellers, driven, in the case of many of the larger vessels, by turbines. Paddle wheels are, however, retained in certain services for which they are peculiarly fitted.

Foreigners have often criticised American steamboats on the ground of unseaworthiness as well as for their liability to rapid destruction by fire. In reply to the first criticism it may be said that the steamboats are usually quite as seaworthy as the conditions of their runs make necessary and that, in this respect, their record is probably as clear as that of any other type of ship, the world over. It is true that some have been lost in heavy gales, off the coast, but so have many ordinary seagoing vessels. In the matter of fire risk the opinions of the critics are better founded. From the insurance point of view, the steamboats, with their light, wooden upper works and long connecting corriders or passages, are undoubtedly a "bad risk" but notwithstanding the fact that there have been some disastrous fires, accompanied by serious loss of life; when the great number of vessels in operation and the enormous number of passengers carried are taken into account, the losses appear to be relatively small and the statistics indicate that traveling by steamboat is at least as safe as by other means of transportation.

For many years the elimination or reduction of fire risk has been one of the principal problems before the builders and operators of our light draft steamers. So called fireproof steamers have, from time to time, been built or projected, but the first cost, and the weight of the materials used, or proposed to be used, have been so great as to prevent any general move in this direction.

In some of the larger vessels, transverse fireproof bulkheads have been constructed, dividing the passenger quarters into several sections and no doubt contributing greatly to the safety of the vessel and localizing the effect of fire. Automatic fire alarm systems are frequently installed and, in conjunction with them, sprinkler systems. In vessels thus equipped, the chance of a fire gaining serious headway is very remote.

While much has been accomplished in the line of fire detecting and control, it is most gratifying to know that the production of a fireproof structure has by no means been abandoned. A number of ferryboats of fireproof construction are in operation and in one recent coast service vessel, as well, a long step in this direction has been made. For all practical purposes, the steamer *Islander*, which is described elsewhere in this issue, is fireproof, and, while in other ways

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a notable vessel, this feature, alone, is sufficient to place the *Islander* in the front rank of recent engineering achievement, and deserving of attention out of all proportion to her size.

Aside from her fire resisting characteristics, the *Islander* is, as we have mentioned, a notable vessel and her designers, the technical staff of the New England Steamship Company, as well as the Bath Iron Works, in whose yards the vessel was built, deserve the greatest credit for the very perfect result of their united efforts. The New England Steamship Company, or, to speak more correctly, its progenitor, the old Fall River Line, was among the first to build large sidewheelers and more, probably, than any other company, has contributed toward making American steamboats famous. The Fall River Line was established in 1847. Very few transportation companies have a record of continuous operation extending back for a period of over seventy-five years, but length of service is by no means the only remarkable feature of this company's history. During all these years, no passenger's life has been lost as the result of accident to any of the Fall River Line steamers, a record which is only equalled, so far as we know, by that of the Cunard Line. It is furthermore interesting to note that the steamer *Pilgrim*, built in 1883, was the first American vessel, of any description, to be fitted with a complete double bottom and also, we believe, the first vessel in the world to be lighted exclusively by electricity. This line was also the first to fit its vessels with the fireproof bulkheads, which we have mentioned, and to install automatic fire alarms and sprinkler systems. As an example of the successful combination of careful, conservative management with progressive engineering achievement of the highest order, the record of the Fall River Line in its many years of service is equalled by few and surpassed by none.

The first of all American steamboats navigated the Hudson and it is fitting that on its waters have since steamed many of the largest and fastest vessels of our steamboat fleet. In such steamers as the *Berkshire*, the *Hendrick Hudson* and the *Washington Irving* river navigation has reached its highest degree of perfection.

While the cargo vessels of the Great Lakes are of an entirely distinctive type, the lake steamboats have followed pretty closely, in general character, their coast prototypes, although the fact that these vessels operate only in summer has tended to modify them in some respects. Today the largest sidewheel passenger steamers in the world are on Lake Erie, and others even larger are in course of construction for lake service. These latter vessels we hope shortly to describe and illustrate in these pages.

The western river steamers form a very distinct type and one so well suited to the peculiar conditions under which it operates that it has remained practically unchanged over a long period of years. With the revival of navigation on the Mississippi and its tributaries, which seems certain to take place in the not distant future, it is probable that the river steamers will undergo certain modifications tending to improve their fuel economy and, in fact, Diesel engines have already been installed on one or two of the smaller vessels.

Although many of our steamers undoubtedly have a strange and uncouth appearance in the eyes of [illegible] accustomed only to seagoing vessels, a very little study will convince even the most sceptical observer as to the efficiency with which they do their allotted work and the truth of the old adage that "Handsome is as handsome does."

Cabin Ships

THE demand for what is known as the cabin ship in the North Atlantic passenger service originated, no doubt, in the reluctance of the average American to travel second class. Notwithstanding the very great degree of comfort and even luxury offered by the second cabin accommodations on many of the large passenger steamers built prior to the war there was a very large class of passengers who, while feeling unable to meet the high rates demanded for saloon accommodation on the fast ships, were, nevertheless, quite unwilling to play "second fiddle" to anybody.

To meet the requirements of this large and rapidly growing class of travelers, and among them are many of the very best type of Americans, comfortable accommodations were installed, early in the present century, on the large cattle steamers, for a relatively small number of passengers of one class. The Atlantic Transport Company, out of New York, and the Leyland Line, out of Boston, were, we believe, the pioneers in this development and its instant popularity taxed to the utmost the somewhat limited accommodations offered.

With the decline of the export trade in cattle, more room for passenger accommodation became available and the profits to be realized from carrying immigrants led to the building of steamers arranged for two classes of passengers, second class, so called, and steerage.

From these beginnings have come "cabin" ships, carrying cabin and third class passengers, and than which, for the average traveler, there is no more satisfactory or comfortable type of vessel.

The main differences between the standard type of Atlantic liner and the cabin ship lie first, in speed, and second, in the extent and elaborateness of accommodation. For most tourists a day or two of additional time spent at sea is an added attraction and certainly no hardship. So far as accommodations are concerned, the staterooms on the cabin ships are smaller than the first class rooms on the regular liners, but are better located and less crowded than the second class rooms on the latter vessels. In fittings and appointments there is little left to be desired by the cabin ships and the quarters are at least equal, and in many respects superior, to the first class accommodation on the crack ships of ten or fifteen years ago. It is true that there are no swimming pools, a la carte restaurants, squash courts and other similar innovations which characterize the latest "luxury" ships, but in our opinion, at least, these details are of more importance because of their advertising value than for any real contribution they may make to the comfort of the average passenger.

There can be no doubt that the cabin ships will continue to grow in popularity and it is a very great satisfaction to know that the very latest word in this class is an American vessel, the *Republic*, which has just gone into service. Elsewhere in this issue will be found illustrations of this remarkably fine ship.

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The First Edmonds Bill

Provisions of the First of Three Shipping Bills Sponsored by Congressman Edmonds

By "Old Scotch"

THE first of three shipping bills to be presented to the present Congress by Congressman George W. Edmonds of Philadelphia, known as H. R. 7685, was introduced on March 6, last, and is intended to embrace such desirable legislation as from previous experience will likely encounter but little opposition. Its caption is "To Amend and Supplement the Merchant Marine Act, 1920, and for Other Purposes."

The first two paragraphs are amendments to Section 9 and 10 of the Act and relate to a broadening of the terms under which the government's interests in any Shipping Board vessel sold into private ownership under the deferred payment plan may be insured.

Immigration

Title II of the bill relates to immigration to the United States, and requires that as nearly as practicable one-half of the total number of immigrants admitted to the United States in any fiscal year shall be transported in vessels registered or enrolled and licensed under the laws of the United States. Provision is made so that, if this requirement contravenes any existing treaty with a foreign country, the President shall take such steps as may be necessary in his opinion to remedy the conflict.

This is a perfectly equitable and fair provision. Immigrants come to this country because they can better their living conditions, and not because we have invited them to come. As many of them save up their earnings here and return to the land of their birth to spend it, we should at least have some of the benefits they receive for the support of our ships in the passenger service. It is generally understood that large numbers of immigrants form about the best-paying part of the transatlantic trade, and we should get our share of that business. We might go even further in asserting our rights by putting in the bill a proviso that no one of these foreigners, who fails to take up citizenship, will be allowed to depart permanently unless he goes home in an American ship. There is no good of "pussyfooting" with this modern type of buccaneers.

Pilferage

Title III is devoted to the important subject of "Pilferage," and makes the existing laws applicable to all kinds of common carriers by water: heretofore these laws applied mainly to common carriers on the land. There have been huge losses in shipping, due to theft and damage to cargoes, and the laws have not been definite and stringent enough to act as much of a deterrent to such crimes. As an aftermath of the war the general lowering of the morals of the community was very much in evidence in the thieving and wilful destruction of all kinds of goods entrusted to common carriers both on land and sea. While conditions have improved somewhat, there is still a strong necessity for the enactment of this section to protect shippers by water.

In recent years the need of loadline legislation for American vessels is becoming acute. Several ineffectual attempts have been made in the past three or four years to have a loadline bill passed by Congress. Once it passed the House by practically a unanimous vote. When it reached the Senate it was defeated by inaction, due largely to the powerful influence of certain shipowners interested only in the coastwise trade. As the results of an intensive study made by a committee of experts, it was found from records of ship losses covering a number of years past that our vessels in the coastwise trade have been singularly free from losses attributable to overloading.

Loadline Regulations

With foreign trade it is entirely different, as the majority of the great maritime countries of the world have adopted stringent laws governing the loading not alone of their own vessels, but of all foreign vessels leaving their ports. This has placed American vessels at a decided disadvantage, as their owners know full well that without any warning the great nations with which we trade can detain any American vessel from leaving their ports unless they are submitted to a thorough inspection and a compliance with the loadline laws governing all vessels about to depart from their seaports. Fortunately for us international courtesy has permitted this to go on without interference, but the time has now come when we must have our own laws on the subject, so that our vessels may be treated in respect of loading, reciprocally, with vessels of the other maritime countries, as a matter of right and not of courtesy. Hence Mr. Edmonds has included loadline regulations under Title IV of his bill, which direct that American vessels engaged in foreign trade only must have official loadline assignments, based on rules recognized internationally, so that in respect of loading, all vessels of the world may be governed alike.

The Secretary of Commerce has appointed a select committee representing shipowners, shipbuilders and underwriters, under the chairmanship of that leading naval archi-

Congressman Edmonds

CONGRESSMAN GEORGE W. EDMONDS of Philadelphia, ranking next to the chairman of the committee on merchant marine and fisheries in the House of Representatives, is one of the most active members of Congress in all that pertains to the building up of our merchant marine. Under his skilful guidance the subsidy bill was passed last year in the Lower House, the first time that body has ever passed a bill of that kind, although a similar bill was passed by the Senate in previous years on two different occasions. Mr. Edmonds has made an intensive study of merchant marine requirements, and when he introduces bills, they are always well considered. He bears in mind the introduction of three distinct measures in this Congress, which, if ever enacted, will prove of great benefit to our shipping interests in the foreign trade.

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tect, Admiral David W. Taylor, former chief constructor of the Navy, who advised him in the preparation of the bill, and who undoubtedly will be asked to prepare the regulations under which the law will be administered if Congress gives the matter its approval.

MARINE BRANCH OF DEPARTMENT OF COMMERCE

Title V of the bill is devoted to the long discussed combination of all governmental activities having relation to maritime matters, under one department, and specifically under a new so-called "under-secretary" of the Department of Commerce, to which division of the government it logically belongs. It contemplates that the Bureau of Navigation, the Bureau of Coast and Geodetic Survey, the Bureau of Lighthouses, the Bureau of Fisheries, the Hydrographic Office, the Naval Observatory, the former Life-Saving Service (now an integral part of the Coast Guard) the Great Lakes Survey, and the Treasury activities relating to measuring and documenting of vessels, shall all be consolidated under this new branch of the Department of Commerce. This is practically putting into legislative form the recommendations of the so-called Efficiency Committee which has labored on a rearrangement of governmental activities since the present Administration came into power.

From the viewpoint of the shipping man who is compelled to deal with the various ramifications of the government, there is much to be commended in this proposed consolidation of maritime regulatory branches in Washington. It now takes a wise man to know just where these various activities are located in the complex of Washington offices. Since this proposed consolidation was first recommended, it has been determined by Congress that the Coast Guard shall be the arm of the government for prohibition enforcement at sea and along our coasts. As the cutters at sea must actively cooperate with the Coast Guard stations along the coast, it would appear somewhat incongruous, under this new assignment of duties, to have these two principal elements of the existing Coast Guard placed under separate administrative heads. The Coast Guard is declared by law to be a part of the military forces of the government, and it would therefore seem to be advisable to let the existing arrangement stand as it is.

An interesting paragraph in this proposed consolidation is the proviso that General George Uhler and former Commissioner Chamberlain shall be placed on the retired list at 75 percent of their present salaries. This would be a very appropriate action of the government, in consideration of the long and honorable service which these gentlemen have rendered to the maritime interests of the country.

ABOLITION OF ARMY AND NAVY TRANSPORT SERVICES

Title VI would put in effect the practical abolition of Army and Navy Transport Services in times of peace. This subject has been threshed over time and time again in various congressional committees, and the consensus of opinion among legislators seems to be that these duties should be performed by private vessels, and that they could be performed at less cost to the government. The subject is still a matter of controversy among the proponents on either side of the question, although the ultimate disposal was probably foreshadowed by the committee action when this item was considered in the subsidy bill in the last Congress.

RAIL AND WATER TRANSPORTATION

Title VII is devoted at length to Provisions Relating to Rail and Water Transportation. Briefly it proposes to set up a joint board, composed of representative members of the existing Interstate Commerce Commission and the Shipping Board, to consider and study the conditions and interrelations of rail and water traffic, and in general to promote and encourage water and rail transportation in every way in order to foster the commerce of the United States.

Water and rail transportation of our export products are now so vital to our business success as a nation, that much good can be accomplished by a joint board of the kind contemplated, where scientific co-operation may be engendered which should result to the best interests of the common welfare.

MISCELLANEOUS PROVISIONS

Title VIII "Miscellaneous Provisions" contains a number of minor sections deemed necessary for the benefit of the merchant marine. The first is the provision that all people traveling at the expense of the United States shall, when practicable, travel in a public vessel of the United States or a vessel registered, or enrolled and licensed, under the laws of the United States.

This provision would receive practically a unanimous vote in both the House and Senate, if it comes to a vote, as there is a practical unanimity of opinion in Congress that this should be done. As a matter of fact, if you watch the sailings for Europe in the time when Congress is not in session, it will be observed that Senators and Congressmen almost invariably patronize vessels flying the American flag, thereby setting an excellent example to other government officials to encourage ships of their own country. All honor to such good Americans as Gen. John J. Pershing, who on his recent return from Europe gave out in his interview on arrival that American ships are splendid to travel on, and advised his fellow-countrymen to patronize them, just as Englishmen and Frenchmen patronize the ships of their own flags.

Other paragraphs in this Miscellaneous title provide for the transportation of government supplies in American bottoms wherever practicable, prescribe what shall be published in the annual reports of the Shipping Board and of other corporations managed or controlled by the Board, prescribe what shall be the home ports of vessels and elucidate the requirements for documentation of various kinds.

Taken altogether, this bill, if passed, will prove of great benefit to American shipping, and, as it contains very little of controversial matter, its passage should be assured, if it is acted upon by the committees with reasonable promptness. Of course, the greater part of this session is practically over, and but little has been accomplished in the way of general legislation. With the tax bill and the bonus measure disposed of, the innumerable investigations completed as they probably will be in this session, the General Elections over in November, the next and short session of Congress may be productive of some good legislation of the kind contained in this, the first of the Edmonds bills. Let us hope so at least.

(Photograph by Keystone View Co., N. Y.)

Pacific Cannery Fishing Fleet

Thirty-one sailing vessels, with their crews of over 4,000 men and full equipment for five months' service, which left Alameda Estuary, Calif., on April 2, for their respective fishing canneries conducted by the Alaska Packers' Association. The expedition represents a cost of $3,000,000.

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New Scheme for Reducing Unemployment in England

Viscount St. Davids Proposes Government Aid for Building New Tonnage on Speculation—Ships Building Under Trade Facilities Act

By W. H. Wendon

THE idea of State intervention in regard to the building of new steamship or motorship tonnage "on spec.," that is to say, on the off-chance of buyers being found for the vessels at the termination of building operations, has again been resuscitated in the United Kingdom and is causing serious concern in shipowning circles. Viscount St. Davids—a brother of Viscount Kylsant, head of the Royal Mail group of shipping companies and a past-President of the Chamber of Shipping of the United Kingdom—is again responsible for the suggestion. Briefly, his view is that the Government should call the shipbuilders of the kingdom together, or, at all events, those of them whose yards are nearly empty, and ask them whether they would like to build a ship, or more than one. Viscount St. Davids draws the conclusion that such terms could be offered so that, in the event of a profit being realized on the construction of a vessel, the builder should have three-fourths of that profit, while, if the ship was sold at a loss, the builder should bear half the loss and the Government the other half making the risk less hazardous for the builder.

That, in a few words, is Viscount St. Davids' scheme, and, while it should not be confused with the functions of the Trade Facilities Act Advisory Committee, which body has already guaranteed several millions sterling to shipowners who desired to augment their fleets, the plan is, in its general purposes, and from the shipowners' viewpoint, "on all fours" with the objects of the Trade Facilities measure. Shipowners have not accorded the proposal their whole-hearted enthusiasm, and in many notable instances are strongly opposed to the suggestion; but, inasmuch as Viscount St. Davids had already confessed that his plan would be unpopular among shipowners generally, little disappointment has been occasioned in that quarter. The view of representative shipowners is that it is unreasonable, if not downright uneconomic, to swell the existing surplus of ocean-going steamship tonnage, but they are naturally in agreement with Viscount St. Davids' declaration that keener efforts should be made in this country and abroad to scrap many of the less efficient laid-up vessels. This line of action is, in fact, being adopted in many quarters, although not with the rapidity that leading owners desire.

Viscount St. Davids' plan has for its main object that which led to the "sister" measure, namely, the Trade Facilities Act, in that both aim at reducing unemployment in the shipyards throughout the kingdom. While, however, shipowners are naturally sympathetic in regard to any proposal which has as its objective the lessening of the hardships endured by the workless, or those on "short time," it is their considered opinion that building still more surplus ships under State auspices would merely be "robbing Peter to pay Paul," insofar as the boats, when completed, may be quite unable to find employment, so that the last case would be as bad as the first. Builders, of course, do not see eye to eye with all these protests of owners.

"The less artificial stimulus there is to trade the better," states one shipowner. "A case is reported to have occurred recently where the lowest tender received from a British firm for the building of a ship was over 35 percent higher than the price accepted for the work to be done on the Continent. That being so, is it any use bolstering up an industry by the means suggested, seeing that British shipbuilding cannot compete with Continental yards? Artificial assistance is going to increase the cost, already too high. Government interference cannot cheapen things; the effect is the opposite." This authority adds: "What is the good of speculative ships? Those shipowners who, under pressure, were compelled to take standard ships and German tonnage after the war have been inconvenienced ever since, being hampered in successful trading by the possession of ships not built for their purpose. The efficient shipowner does not require Government aid and guarantees. The trouble with shipowners is not lack of capital, but that the cost of shipbuilding is too high."

A Lean Time for Shipbuilders

Judging from their annual reports and balance-sheets—usually a pretty true index—shipbuilding and repairing concerns in the United Kingdom are experiencing a lean time. This unhappy condition has been mainly brought about by two things—in the first place, of course, the great trade depression, and in the second place by oft-repeated and protracted disturbances in the shipyard labor world. Reduced dividend distributions are becoming unpleasantly frequent, where, in fact, the dividend is not actually passed. The leading shipowning companies, too, continue to report unfavorable financial results, particularly in the South Wales district, where "tramp" concerns were floated on an immense scale in the "boom" period.

Apropos tramps, there has been considerable speculation as to what the future holds for boats coming under this category. Lord Kylsant, who occupies the peculiar position of being an owner of "tramp" as well as of liner tonnage, maintains that there is no ground for the apprehension in some quarters that with the increasing number of what have become known as "cargo liners" ordinary tramp ships must necessarily find their field of employment greatly curtailed. The solution of this little problem seems to lie midway between the cargo liner and what has been rather apologetically termed "the ubiquitous tramp." Many owners of tramps will take heart from Lord Kylsant's expression of opinion that "tramps will always continue to carry out an important function in worldwide commerce which can never be adequately fulfilled by any other form of ocean transport."

Motor Cargo Vessels

A "line" on the motorship problem has also been vouchsafed by this same authority. In regard to cargo vessels, he evidently regards the installation of internal combustion engines in "tramps" as still a problem to be settled only after the lapse of a few years, which is not quite so optimistic a front as shipbuilders would have him present. But Lord Kylsant confirms the impression that the present high first-cost of motor engines—always accepted as one of the greatest obstacles militating against the more general adoption of the type—as compared with steam engines should gradually be reduced as the makers get down their costs of production by increased manufacture. Diesel engine makers have, of course, recognized all along that this is one of the vital factors in the motorship problem, and they are naturally doing all they can to persuade owners to assist them in bringing about the necessarily increased volume of construction in order to effect the reduction in first-cost so much desired.

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SHIPS BUILDING UNDER TRADE FACILITIES ACT

So much interest has been taken, both inside and outside the United Kingdom, in regard to the sums guaranteed to British shipowners and others in connection with the construction of new vessels that summarized particulars of the more important transaction should prove instructive. Subjoined are the details, the "Years" column signifying, of course, the period over which the repayment of the sum guaranteed is permitted to run:

Name	£	Years	Purpose
William Beardmore and Company, Ltd.	600,000	5	Completion of vessel at Beardmore's yard for Societa Anomina per Azioni Lloyd Sabaudo.
Harland and Wolff, Ltd.	95,000	1	Completion of vessel at Greenock.
Liverpool, Brazil and River Plate Steam Navigation Company, Ltd.	200,000	7	Completion of ship already partly built.
Glen Line, Ltd.	200,000	7	Completion of ship already partly built.
R.M.S.P. Meat Transports, Ltd.	2,300,000	7	Construction of three ships.
Union-Castle Mail Steamship Company, Ltd.	1,000,000	7	Construction of ship.
Bank Line, Ltd.	1,800,000	20	Construction of 19 motorships at Govan.
Atlantic Transport Company, Ltd.	400,000	5	Construction of ship at Belfast.
Anchor-Donaldson, Ltd.	400,000	10	Completion of ship already partly built at Govan.
Bellailsa Steamship Company, Ltd.	37,000	10	Construction of ship at Port Glasgow.
Waverly Shipping Company, Ltd.	37,000	10	Construction of ship at Port Glasgow.
Grahamston Shipping Company, Ltd.	20,000	10	Construction of ship at Burntisland.

One of the fairly numerous novel suggestions which have arisen from the introduction of the Trade Facilities Act is that which relates—or, at all events, has been made to relate—to the load line. A Socialist (or Labor) Member of Parliament (Mr. N. Maclean) objected to the fund being used to guarantee the building of ships on the ground that there are already at least 600,000 tons of surplus shipping. He suggested to the President of the Board of Trade, therefore, that he should bring the Plimsoll load line back, maintaining that, with the re-establishment of the Plimsoll line, the existing surplus of 600,000 tons would not be sufficient to make up the million tons "which the abolition of that load line gave to the shipowners." Competent quarters have, however, pointed out that the load line is fixed under an international agreement, and that, if Great Britain increased the freeboard, it would simply be at the expense of her own shipowners, who would be forced to carry less cargo on every voyage; while, more important still, the re-establishment of the Plimsoll line would, it is maintained, not affect the safety of the ships to the slightest degree. In this connection, statistics have just become available regarding shipping casualties and deaths of seamen, the figures tending to prove that the raising of the load line has not added to the loss of life. Bearing in mind the great increase in the amount of steam tonnage employed, combined with the larger number of seamen engaged, the fact that deaths from casualties are falling is quoted as proving that the raising of the load line has not contributed to loss of life.

MUTUAL ASSOCIATION FOR PROTECTION OF FREIGHTS

Suggestions are frequently made in the principal maritime countries with a view to solving the shipping problem, so far as periods of depression are concerned. The most recent of these schemes has reference to the formation of a mutual association for the protection of freights. The germ of the idea is this:

"It is in the interest, especially of the regular lines, that freights should maintain certain stability, because every drop in freights in the open market immediately affects the freights of regular liners from the ports in question. Tramp steamers have more liberty of action and usually divert tonnage where it suits them best and are therefore less affected.

"If the Bombay freight is 30s., and a tramp owner accepts 25s. the berth rate for liners would certainly drop, whereas the tramp owners would not go to Bombay. In order not to allow them to drop unreasonably low, an indemnity should be given to owners for loss of time for holding out."

The "practical" part of the proposal is that a central committee should be formed in London to act with the committee of Lloyd's Register, with delegates from all owners who would spontaneously agree, the idea being that this committee should obtain the adhesion of two-thirds of the world's tonnage, and especially of owners of regular lines, and that through secretaries, it should manage a kind of mutual insurance club for a reasonable protection of freights. Furthermore, every owner should pay, or undertake to pay, to the common fund 1d. per ton per day, that is, 2s. 6d. per ton for a month once a year, which, the promoter of the scheme estimates, would cover the loss incurred through the detention of steamers holding out for higher freights. The maximum indemnity would be for thirty days, provided always that during this period the steamer was kept in full equipment, not laid up, and that the delay was not caused by repairs, strikes, etc.—in other words, the detention must be incurred voluntarily in order to keep freights up to a reasonable level. Experts, however, consider that the scheme would never work out in practice, firstly, because it would be impossible either to secure the adhesion of two-thirds of the world's tonnage or to get the liners to come in, and secondly, because cargo boat owners would not agree to contribute during good times, and (so it is contended) would certainly not pay out money in bad times for the benefit of other owners to enable them to lay up their vessels. But the most telling argument against the adoption of such a scheme is considered to be the impossibility, either now or in the future, of adjusting the shipping tonnage balance in such manner as to prevent slumps.

Congressman Edmonds and Admiral Palmer Will Address Marine Dinner in New York on May 15

CONGRESSMAN GEORGE W. EDMONDS of Philadelphia and Admiral Leigh C. Palmer, president of the Fleet Corporation, will both speak at the dinner and conference of the American Marine Association to be held at the Waldorf-Astoria Hotel in New York on the evening of May 15. Other prominent speakers will also address this spring gathering of the Marine Association.

Representative Edmonds is known throughout the country as one of the leading members of Congress in regard to marine affairs. He is the leading advocate of the plan for Dieselization of the Shipping Board vessels and has been active for beneficial marine legislation since entering Congress. He will have an important message for the country as a whole, and the marine interests in particular. Admiral Palmer will likewise have an important story to tell at the spring dinner.

Frank Shipman, president of the American Marine Association, will shortly announce other speakers of national prominence who will address the May dinner and meeting.

SUBMARINE DIRECTION FINDING APPARATUS, as manufactured by the Submarine Signal Corporation, Boston, Mass., has been installed on the lifeboats of the *Leviathan*, making it the first liner to be equipped with these new devices. The motor lifeboats are equipped with portable direction finders and every lifeboat has on board a submarine sounder.

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Savings Plan of the Lake Carriers' Association

Banking Facilities for Seamen Provided on Great Lakes Freighters—Over $6,000,000 Deposited in Thirteen Years—Thrift Encouraged

By George A. Marr*

EVER since the advent of the bulk freighter whose evolvement simultaneous with the development of the Lake Superior iron ore region has made it possible to move more than one hundred million tons of coarse freight in the short season of navigation, lake seamen have been the best paid seafarers in the world. Theirs has been a good saving wage, yet notwithstanding that a large proportion hail from the villages and farms contiguous to the region of the Great Lakes, they were as improvident as the sailors of the salt seas. The habits of both were much alike. Moreover, they were also the object of that class which from time beyond memory has preyed upon seamen, so that what the lake sailor did not dissipate himself was taken from him either forcibly or by deception.

The Welfare Plan of the Lake Carriers' Association was established in 1909 and as its purposes were to look after the well being of the men who man the bulk freighters, as much as for providing personal conveniences, it was soon realized that the Welfare Plan could do no greater work than to correct the traditional habits of lake seamen by conserving their wage earnings; in other words transforming them from spenders into savers.

Lake Sailors Become Savers

The lake trade is such a diversified traffic that an ore and coal carrier may not go into the same port to unload twice in a month and perhaps only a few times in an entire season. Necessarily, however, any undertaking pointing toward a systematized method of banking must be established at a port on Lake Erie, in fact at Cleveland, from which port nearly all the vessels are managed and from which practically all the business in ore, coal and grain is transacted. It so happened that the chairman of the Welfare Plan Committee, the late J. H. Sheadle, whose interest in the men was unusually keen, was also an active director in the Cleveland Trust Company. After having taken up in the rough the matter of providing banking facilities for the men on the freighters, the bankers readily devised a plan which was simplicity itself and under which the men were enabled to make deposits and withdrawal of funds in the bank without the necessity of leaving the vessels.

How the Banking Plan Works

To each vessel there was sent a portfolio containing an equipment for banking by mail, consisting of blank draft forms in triplicate for deposits. When the unlicensed seaman is being paid off at the end of the trip and signifies the proportion of his wages that he desires to bank, the master makes out a draft on the vessel owner, mailing the original to the trust company; one of the carbons he mails to the vessel owner to notify him that draft has been made on him while the other carbon he retains for his own record. As soon as the draft is paid a pass book is mailed to the depositor.

To obtain funds from the bank is even more simple. The master has only to make out a withdrawal order that is mailed to the bank which then returns a New York draft made out to the depositor or sends it to anyone named; or a foreign draft to any country in the world. The seaman also has the privilege of withdrawing money by writing for it over his own signature telling where the money shall be sent and he can of course withdraw his funds in person when in Cleveland.

Altogether the method of banking aboard ship is as simple and understandable as it is unique and original. The Savings Plan was established in 1911 and not one dollar has been lost in transmission during the thirteen years of its existence.

The Savings Plan a Success from the Start

Obviously the primary idea in establishing the Savings Plan was to cure the men of the habit of unwisely expending their earnings and of eliminating losses through theft. Naturally the entire fleet of Lake Carriers' vessels could not be expected readily to respond to the undertaking and nothing at all was expected from those vessels managed in cities at a considerable distance from Cleveland. Furthermore, where masters from the upper lakes ports brought their crews with them, whatever banking was done was usually with a home bank. In such cases, therefore, local conditions governed. Nevertheless, the Savings Plan was an unqualified success from the beginning.

The sailor may be a hard fellow to teach new tricks and he likes to carry plenty of money in his clothes but when once convinced that a thing is being done for his own good he is unstinted in his support. In 1911, the first year of the Savings Plan, total deposits amounted to $106,399, with a balance at the end of the season of $69,972. By the end of five more years total deposits had risen to $1,661,281 and a balance totaling $511,245. The total number of accounts that had been opened numbered 10,230, of which 2,511 were active.

Growth of the Plan

As evidence of the growth of the Savings Plan, bearing in mind that in the initial season deposits totaled only $106,399, the following table comprehensively covers the monthly business of the Savings Plan during the seventh season of its existence:

	Accounts in Force	Monthly Deposits	Monthly Withdrawals	Balance on Deposit
May	2,874	$34,592	$10,074	$338,379
June	3,313	59,713	24,367	412,516
July	3,529	79,530	33,936	477,704
August	3,595	79,339	5,894	535,405
September	3,599	78,086	41,542	583,821
October	3,606	76,978	40,668	630,118
November	3,513	80,565	48,911	671,104
December	3,140	46,651	111,656	615,191

At the end of 1923, covering thirteen seasons of navigation, and in which there have been some lean years, total deposits were in excess of six million dollars. The total of accounts opened numbered more than 21,000.

Over $6,000,000 Deposited

The experience from the beginning has shown that where the vessel manager evinced constant interest in the Savings Plan and urged his masters to bring all their influence to bear upon the crews in the matter of banking as much wages as possibly could be spared fine results have accrued. For this very reason the fleet of the Cleveland Cliffs Iron Company, managed by Mr. Sheadle, was not only outstanding during the six years before his death but as a tribute to his memory the captains of the fleet have ever since continued to exploit the Savings Plan aboard ship and in point of

*Secretary and Treasurer, Lake Carriers' Association, Cleveland, O.

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largest seasonal deposits have kept their vessels in the foreground.

No more positive proof of what can be accomplished in the direction of encouraging thrift among seamen and of exemplifying the results of cooperation between the vessel manager and the master can be furnished than the recent experiences of two fleets in the membership of the Lake Carriers' Association. In 1923 an intensive campaign was carried on by the Cleveland Cliffs Company and the consequent effect on the masters was that the crews on every vessel saved more money than ever before. As an example of what can be done the savings record of the Cleveland Cliffs fleet for the navigation season from a little after May 1 until December 12 is given as follows, cents omitted:

SAVINGS RECORD OF CLEVELAND-CLIFFS FLEET, MAY 1 TO DECEMBER 12, 1923

Steamer	No. of Accts.	May-June	July	August	September	October	November	Total
Angeline	46	$2,311	$2,715	$2,478	$2,229	$2,394	$1,029	$13,157
Cadillac	31	1,923	945	1,488	904	1,124	247	6,642
Central West.	25	1,519	1,236	1,195	1,148	667	1,902	7,667
Christopher	13	777	398	105	275	25	55	1,635
Fontana	39	2,581	1,575	1,300	2,057	1,739	2,009	11,261
Frontenac	12	.....	378	632	703	610	780	3,103
Grand Island.	25	1,102	283	620	989	480	159	3,634
Ishpeming	45	2,119	1,418	1,098	1,028	826	2,602	9,091
Lewiston	13	90	955	310	.....	452	85	1,892
Luzon	7	255	50	215	250	50	200	1,020
T. K. Maher.	44	2,420	1,660	1,552	1,596	1,014	1,472	9,715
Marquette	39	3,333	2,180	2,041	1,971	1,599	1,514	12,638
W. G. Mather.	43	3,321	1,527	1,789	1,666	1,165	874	10,342
Michigan	72	6,594	3,660	3,240	2,659	4,634	3,161	23,949
Munising	29	1,878	1,569	1,193	528	905	282	6,357
Negaunee	32	2,650	1,237	976	1,185	810	699	7,557
R. J. Paisley.	22	2,306	1,623	1,652	1,479	1,763	995	9,818
Panay	31	1,280	973	2,126	398	631	539	5,867
Pioneer	60	4,545	1,526	2,675	2,773	1,130	1,771	14,423
Pontiac	52	3,563	2,574	2,328	2,679	2,037	1,926	15,109
Presque Isle.	50	2,055	1,103	1,032	1,247	1,885	860	8,182
A. E. R. Schneider	41	3,941	2,152	2,147	1,897	1,340	1,977	12,776
C. Schneider.	36	1,952	1,259	1,009	1,444	700	683	7,037
J. H. Sheadle.	62	3,911	3,488	2,823	3,210	2,913	2,691	19,040
Peter White.	53	1,509	2,214	617	1,631	2,466	1,603	14,632
Totals.....	921	$61,934	$38,701	$36,633	$35,932	$33,362	$24,534	$237,209

Aside from the fact that the crews in the Cleveland Cliffs fleet made bank deposits of nearly one-quarter of a million dollars the noteworthy feature of the season's work is to be found in the persistency with which the masters on the vessels with the largest deposits to their credit importuned every sailor who came aboard. It will be observed that on the steamer *Michigan*—she carries 32 men—whose crew deposited $23,949 in practically seven months, the master persuaded 72 different men to open bank accounts. As 72 men is about the maximum number of sailors that will be employed on a large bulk freighter during a season it is probable that not a single man got away on pay days. It will also be observed that on each of the nine other ships whose crews deposited more than $10,000 the number of accounts was well in excess of the ship's complement, ranging from 39 to 62 accounts each.

As a result of a special effort made in the vessel department of the M. A. Hanna Company to induce the men to save their wage earnings the crews on 24 steamers in 1923 banked $110,680. The men on the steamer *R. L. Agassiz* saved $18,555, the men on the *J. J. Turner* $15,615 and the crew on the *D. J. Morrell* put away $10,012.

PRIZES FOR THRIFT

Without having in mind the thought of giving intrinsic reward for the practice of thrift, but rather with the object in view of stimulating interest aboard each ship and of creating a spirit of friendly rivalry throughout the Lake Carriers' fleet, it has been the custom to offer prizes for the vessels whose crews saved the largest proportion of their wages. Inasmuch as the master's influence was paramount the general rule was to give a cash award of $150 to the master whose vessel stood at the top of the list at the close of the season and $100 to the master whose vessel was the runner-up in the contest. But a better arrangement has been made for the season of 1924. To the officers of the ship whose men save the largest part of their pay during the season of navigation prizes will be given as follows: Master $25, chief engineer $20, mate $15, first assistant engineer $10. To the other men in the crew on the winning ship at the close of the season $180 will be divided in proportion to the percentage each man's savings bears to the total savings credited to the vessel. Although this distribution will mean only a small sum to each man lake sailors are keen for competitive contests and at the end of each month impatiently await the result of the standing.

SAILORS BUY FARMS WITH THEIR SAVINGS

To what extent lake sailors have been permanently benefited by the Savings Plan naturally is a matter that never will be known. It needs only a casual analysis of the accompanying statistics, however, to reveal that far-reaching results must have obtained. It is well known that hundreds of men who in the old days were wont to tie up their vessels for the winter left the docks in the cold days of December with only a few dollars in their clothes and were soon without means to sustain them until shore work for the winter months could be obtained. It is a common practice now for unlicensed men to save from $500 to $800. Many have been able, from their savings, to buy farms for their parents or farms or homes for themselves.

Apart from considerations of a humanitarian order, which was the object in view when the Savings Plan was established, it has been proved times without number that on those ships where large bank deposits are the rule all-season crews obtain and are made up of men of sobriety. The standard of efficiency is generally higher on ships of this type.

To Consider Standard Specifications for Condenser Tubes and Ferrule Stock

FURTHER steps toward the efficient development of marine engineering practice will be taken on May 5, when a meeting will be held in the Division of Simplified Practice, Department of Commerce, Washington, D. C., to consider standard specifications for condenser tubes and ferrule stock. The American Marine Standards Committee, in cooperation with the Federal Specifications Board and the American Society for Testing Materials, will cooperate with the Department of Commerce in the program.

In addition to marine interests, representatives of power plants and other interests have been asked to participate.

The conference will be opened and its objects explained by Capt. Q. B. Newman, engineer in chief of the Coast Guard, who is chairman of the Marine Standards Committee on condenser tubes.

Shipmasters' Club Affiliates With Neptune Association

THE Shipmasters' Club of New York has affiliated with the Neptune Association of Licensed Masters and Mates of Ocean and Coastwise Steam Vessels. The club in the future will be run as the Shipmasters' Branch of Neptune Association and will continue in its present quarters.

This affiliation gives to the Neptune Association practically all the deep water master mariners in the country. Many of the active shipmasters were members of the Neptune Association before the affiliation.

EXECUTIVE BOARD TO MEET.—The next meeting of the executive board of the American Marine Standards Committee will be held at 11 A. M., Tuesday, May 6, in room 527, 45 Broadway, New York, at which time various committees will report on progress of work.

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Section Twenty-Eight Under Fire

Enforcement of Section Postponed Until June 20—Opposition Develops at Hearings

By Harold F. Lane

WASHINGTON, D. C.

OTHER developments in the merchant marine situation in Washington during the past month have been overshadowed by the controversy aroused by the long-postponed action of the Shipping Board in trying to put into effect the provisions of section 28 of the merchant marine act. This has stirred up a great deal of opposition among shippers and representatives of various ports of the United States, as well as the railroads, which has manifested itself at conferences with the Shipping Board and hearings before the House committee on merchant marine and fisheries and also before the Interstate Commerce Commission, which has postponed the effective date from May 20 to June 20.

SOURCES OF OPPOSITION

Opposition to the enforcement of the law has also been voiced by representatives of foreign governments, but while the Shipping Board has apparently sought to treat the matter as one concerned primarily with international commercial rivalry the opposition has centered mainly around the question of the effect of putting the section into effect on competing ports and shippers in the United States and of the adequacy of the services which are afforded by Shipping Board vessels. Also, whereas it has been generally supposed that the Interstate Commerce Commission, under the law, was to be merely a rubber stamp to suspend or withdraw its suspension of the provisions of section 28 whenever it was asked to do so by a certificate of the Shipping Board, the point has been raised during the hearings as to whether it has not also some jurisdiction in the matter, at least to determine the effective date, and bills have been introduced in Congress to divide the discretion in the matter between the Shipping Board and the commission.

In its order terminating the suspension, the commission took the position that it had no discretion beyond fixing a date which would allow time for the railroad tariffs to be amended, and for this purpose it set May 20 as the effective date. On petitions representing a large representation of shippers of export and import freight, however, it allowed a hearing on April 17 at which arguments were presented on the question of a postponement and a committee of the commission was to confer with a committee of the board on the subject on April 21.

HEARINGS BEFORE HOUSE COMMITTEE

The hearings before the House committee on merchant marine and fisheries, which were concluded on April 12, were held on a bill introduced by Representative Newton of Minnesota to give the Interstate Commerce Commission a share in the decision as to when conditions are adequate for putting section 28 into effect. Representative Newton's action was doubtless inspired by the Minnesota flour millers, who complained of the discrimination against them because, while their shipments were to be restricted, grain, which has usually been given a parity of rates, was to be exempted. Other protestants who appeared said that the board had not adequate shipping facilities, at least at the points where they desired to use them, and others complained because of the discrimination between different ports, because export and import rail rates do not apply through all ports but usually only where competition has brought about an equalization of rail rates by making reduced rates to one to meet the rates prevailing to another reached by a shorter rail haul. Representatives of the railroads testified that the effect of the section would be to divert tonnage to Canadian rail lines and ports.

While the hearings were in progress a similar bill was introduced by Senator Lodge of Massachusetts and later Representative Newton introduced another to postpone the effective date of section 28 to July 1, 1925. It has been understood that the House committee has been awaiting the action of the Interstate Commerce Commission regarding a possible postponement before making a decision of its own.

While section 28 has been occupying the limelight the select House committee appointed to investigate the affairs of the Shipping Board has been holding hearings at which various critics of the board have appeared and at which the members of the board and officers of the Fleet Corporation have testified to furnish information and answer various charges that have been made.

DIESEL ENGINE BILL PASSED BY HOUSE

The House on April 2 passed the Edmonds bill, H. R. 6202, to amend sections 11 and 12 of the merchant marine act of 1920 to provide for the use of the construction loan fund of $25,000,000 to make 15-year loans at 6 percent for the "substitution of the most modern, most efficient and most economical types of internal combustion engines as the main propulsive power of vessels." The Senate committee on commerce has also voted to report a similar bill favorably. As passed, the bill was in a form redrafted by the committee after receiving many suggestions from the Shipping Board.

CONSOLIDATION PLAN

President Palmer of the Fleet Corporation has submitted to the Shipping Board a plan for the consolidation of five services between North Atlantic and United Kingdom ports. The board began consideration of the plan on April 2, Mr. Palmer and other officers of the Fleet Corporation being called before the board to furnish additional information.

President Palmer has also conferred with C. H. Potter, president of the United States Ship Operators' Association, regarding the method to be followed in revising the managing agency agreements. It was decided that the operators should select a representative and that the Fleet Corporation should be represented by Vice-President Sidney Henry to negotiate and endeavor to reach an agreement to be submitted to the corporation.

SUPERVISING STEAMBOAT INSPECTORS UNDER CIVIL SERVICE

The Senate on March 27 passed the bill S. 1718 amending section 4404 of the revised statutes as follows:

"Sec. 4404. The positions of supervising inspector in the Steamboat Inspection Service are hereby placed under and included in the classified civil service. There shall be 10 supervising inspectors, who shall be appointed by the Secretary of Commerce, in accordance with and under the provisions of the act of January 16, 1883, known as the civil service act. Each supervising inspector shall be entitled to a salary of $3,450 a year and his actual necessary traveling expenses while traveling on official business assigned him by competent authority, together with his actual and reasonable expenses for transportation of instruments, which shall be certified and sworn to under such instructions as shall be given by the Secretary of Commerce."

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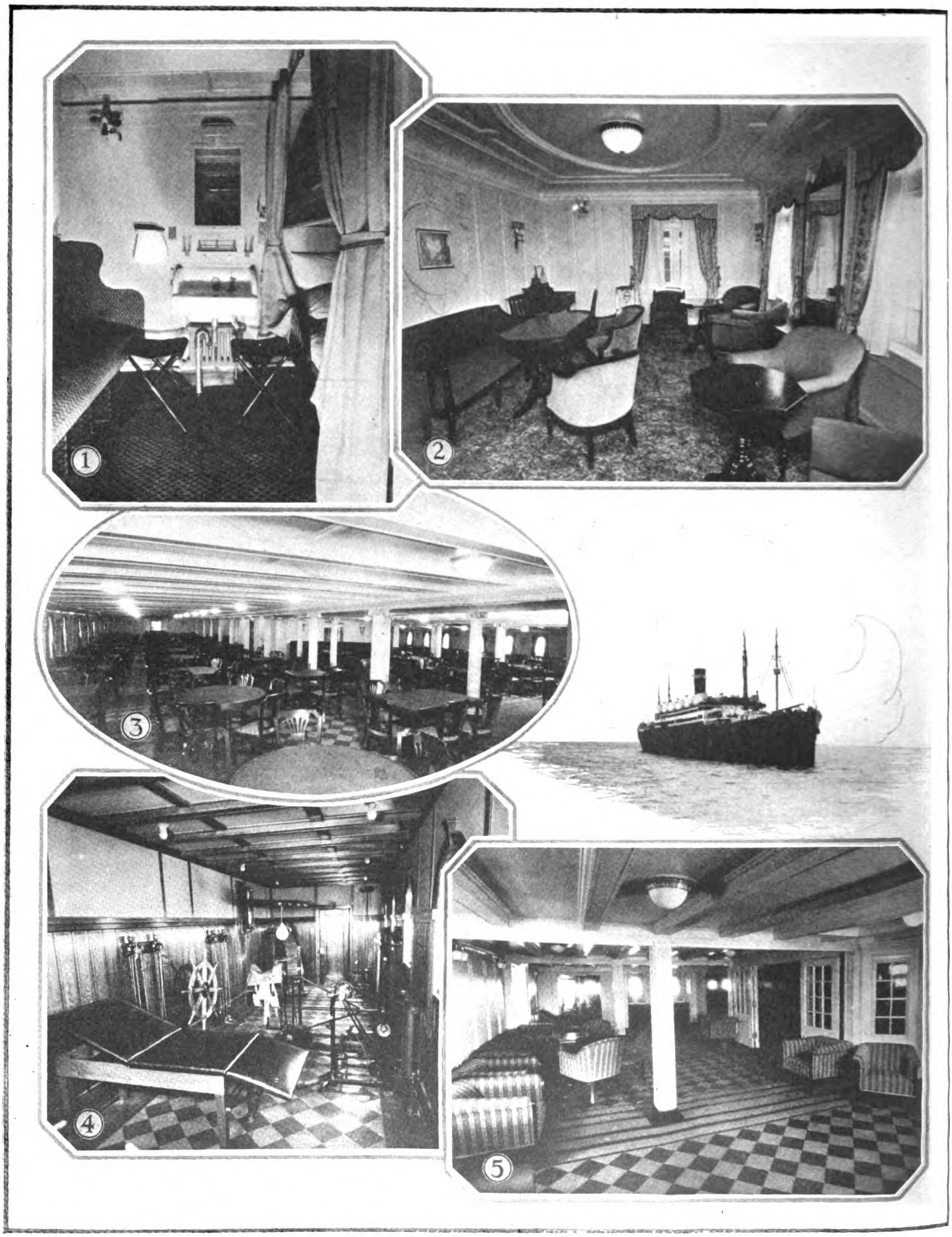

Cabin Accommodations on the S. S. Republic: (1) Stateroom, (2) Ladies' Lounge, (3) Dining Room, (4) Gymnasium, (5) Lobby

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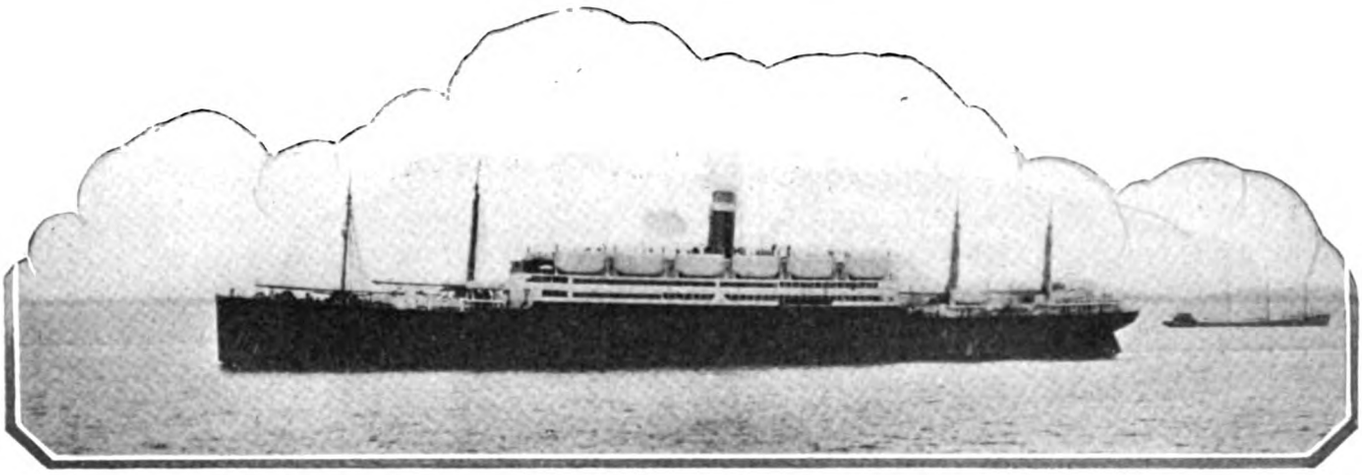

United States Lines' Cabin Steamship Republic

Reconditioned Steamship Republic Goes Into Service

Exceptionally Fine Example of Cabin Type Vessel Rebuilt at Newport News for United States Lines — Converted to Oil Burner

COMPLETELY reconditioned and, in the matter of passenger accommodations, entirely rebuilt, the steamship *Republic* of the United States Lines sailed from New York for Plymouth, Cherbourg and Bremen on April 29 on her first voyage.

Originally called the *President Grant,* and built at Belfast, Ireland, in 1907, there is little about the *Republic* to suggest her initial arrangements and character, and in her the cabin type of liner has, we believe, reached the highest degree of perfection which has anywhere been attained.

The general plan of the reconditioning of the *Republic* (then called the *President Buchanan*) was very fully described in MARINE ENGINEERING AND SHIPPING AGE for April, 1923, but a restatement of some of the particulars of the vessel as reconditioned is undoubtedly of interest. They are as follows:

Length overall	615 feet 3 inches
Breadth molded	68 feet
Depth molded (D deck)	52 feet
Load draft	33 feet
Load displacement	29,250 tons
Gross tonnage	18,070
Net tonnage	11,112

Engines, 2 quadruple expansion, total I. H. P. 7,500.
Boilers, 4 double end and 2 single end Scotch, oil fuel.

Total heating surface	23,503 square feet
Working pressure	215 pounds
Normal speed, loaded	13½ knots
Passengers carried, cabin	605
Third class	1,396
Officers and crew	354

The passenger quarters are much more extensive and quite different in arrangement from those originally fitted on the vessel.

CABIN ACCOMMODATIONS

At the forward end of the *A,* or boat, deck there is a new teak house containing the chart room and pilot house and aft of this a long steel house in which are the writing room, social hall, gymnasium, smoking room and veranda, and also a few cabin staterooms.

The captain's and chief officers' quarters are at the forward end of the *B* deck house, the remainder of this structure being entirely given over to cabin stateroom accommodation. On each side is a spacious promenade, glass enclosed for over half its length.

The main cabin entrance lobby is just forward of midships on the *C,* or bridge, deck, with a large number of staterooms forward and aft of it. There is also promenade space, partly glass enclosed, on this deck.

In the bridge house on the *D,* or upper continuous, deck of the ship, there are cabin staterooms on the port side and on the starboard, a working passage from which open officers' and engineers' staterooms and messrooms, etc. Inboard of the working passage is another, between it and the machinery casings, which forms a means of communication between the third class quarters at either end of the vessel.

The cabin dining saloon, seating 380, is on *E* deck with pantries and galleys immediately aft of it, and on the *F* and *G* decks are additional cabin staterooms.

The scheme of decoration of all the public rooms is in most excellent taste and gives an effect of light and airiness which we believe is much more preferable, to the average passenger, than elaborate and ornate carving and gilding.

THIRD CLASS ACCOMMODATIONS

The third class passengers are accommodated in four and six berth rooms on the *E, F* and *G* decks, with a dining saloon, seating 680, on *E* deck and comfortable public rooms, in separate houses, on *D* deck. The third class quarters are most thoroughly and comfortably fitted out, and include a complete hospital with operating room and isolation ward, laundry, baths and canteen.

In every respect the reconditioning of the ship has been most thorough. The electric system has been entirely renewed, even including the installation of new generators furnished by the General Electric Company. The plumbing fixtures, supplied by A. B. Sands and Son Company, and piping are entirely new, and a very extensive mechanical ventilating system has been installed. In effect, the *Republic,* in everything pertaining to passenger accommodation, is a new ship.

The propelling machinery has been entirely overhauled and an additional single end boiler installed. Oil burning apparatus has been fitted for all boilers, this entire equip-

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Smoking Room

Social Hall

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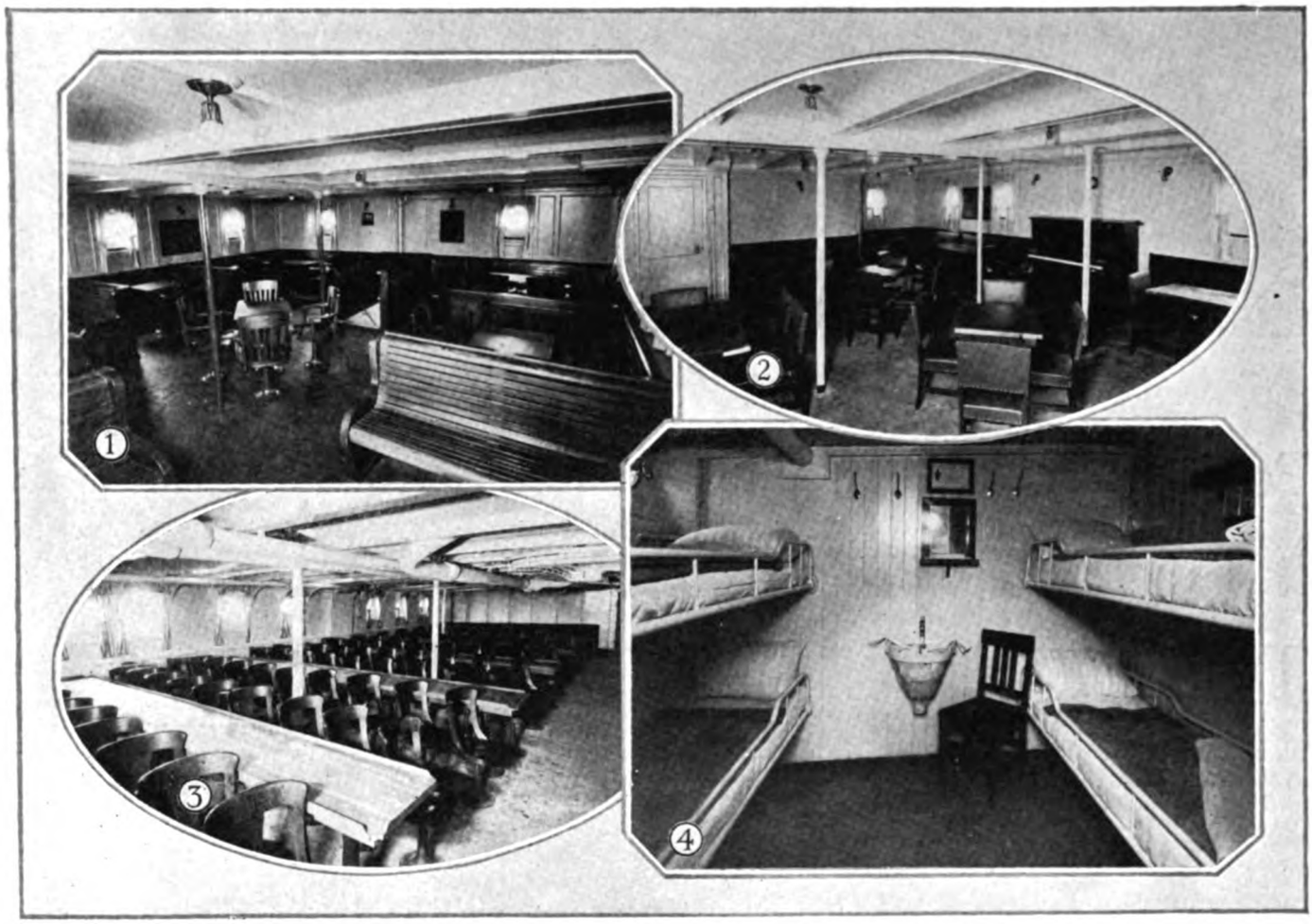

Third Class Accommodations: (1) Smoking Room, (2) Social Hall, (3) Dining Room, (4) Four-Berth Stateroom

ment being furnished by the White Fuel Oil Engineering Corporation.

Every practicable recent development which tends to increase safety and comfort has been taken advantage of in outfitting the vessel. Firescreen bulkheads have been constructed, dividing the passenger quarters into compartments of relatively small size thus limiting the effect and facilitating the quick and effective control of an incipient blaze; in addition, the main staircases are surrounded by fire-resisting enclosures. The Rich system of fire detecting is fitted in all holds and similar spaces and automatic fire alarms throughout the living quarters. The boat outfit is very complete and includes two motor-driven lifeboats, all boats being served by mechanical davits of the Steward type.

A complete gyro compass equipment, and a gyro steerer, have been installed on the ship by the Sperry Gyroscope Company.

An item of particular interest in connection with the outfitting of the *Republic* is the fact that all cooking, both in cabin and third class, as well as in the crew's galley, is to be done by electricity. This outfit, which, we believe, is the most extensive of its type yet to be installed on a commercial vessel, has been furnished by the Edison Electric Appliance Company.

An inspection of the *Republic* gives one a surprising sense of completeness, solidity and carefully worked out details in every department.

The firm of Gibbs Bros., Inc., New York, which planned and supervised the reconditioning, and the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., which carried out the work, are alike to be congratulated upon the perfection of the results attained.

Following is a partial list of principal firms that have supplied machinery and equipment for the *Republic:*

A. B. Sands & Son Company, plumbing; Diehl Manufacturing Company, ventilating fan motors; Sperry Gyroscope Company, gyro compass; Charles Cory & Son, Inc., electric whistle, magna vox, call bell annunciator, etc.; Lidgerwood Manufacturing Company, lifeboat winches; Chase Metal Works, copper pipe and condenser tubes; General Electric Company, the main generator set and bracket fans; Kearfott Engineering Company, Morison suspension furnaces and Laylock sliding windows; Marine Decking & Supply Company, Lit-O-Sil-O and blocks; B. F. Sturtevant Company, ventilating fans; Westinghouse Electric & Manufacturing Company, motor generators for interior communication system, main switchboard; Warren Steam Pump Company, steam pumps; National Meter Company, fuel oil meter; Haskelite Manufacturing Company, laminated board; Davis Engineering Company, feed water heater; Pneumercator Company, pneumercators; Pantasote Company, vehisote; Walter Kidde Company, Rich fire detecting system; Electric Storage Battery Company, storage batteries; American Schaeffer & Budenberg Corporation, thermometers; York Manufacturing Company, refrigerating equipment; Standard Motor Construction Company, gasolene engine for motor boat; Edison Electric Appliance Company, electric galley and pantry equipment; National Tube Company, steel tubes; Crane Company, valves and fittings; Winton Engine Works, auxiliary generating set; American Brass Company, tobin bronze bars, piping, etc.; Diamond Power Specialty Company, soot blowers; Columbian Rope Company, manila rope; Griscom-Russell Company, filter; Lunkenheimer Company, valves; Brunswick Kroeschell Company, brine coils.

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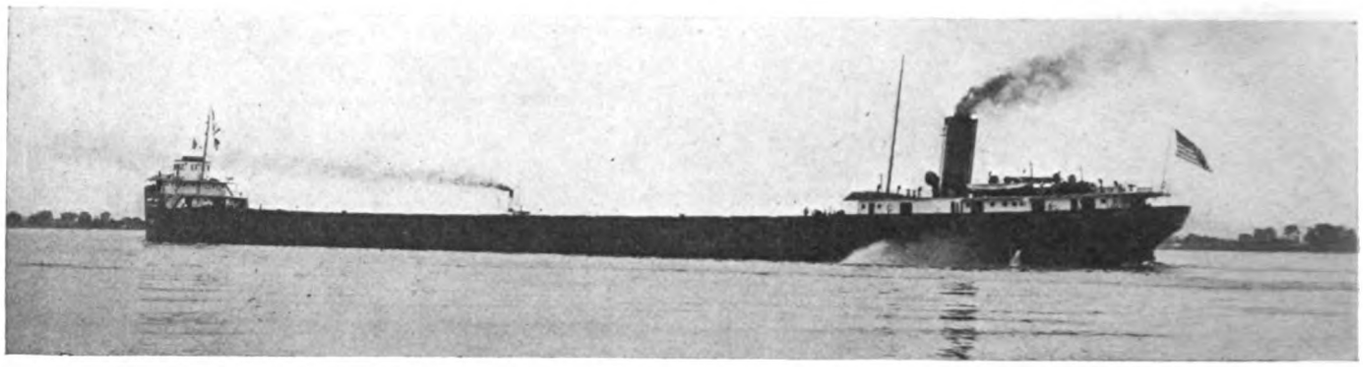


Great Lakes Bulk Freighter Charles M. Schwab, on Which Exhaustive Tests Were Made

Performance Tests of Steamship Charles M. Schwab

Unusually Comprehensive Tests Carried Out on New 600-Foot Great Lakes Bulk Freighter Built by the American Ship Building Company

THE new freight steamer *Charles M. Schwab*, built by the American Ship Building Company, Cleveland, O., for the Interlake Steamship Company, managed by Pickands-Mather & Company of Cleveland, is one of the latest and most completely equipped ore carriers produced on the Great Lakes. The vessel is classified under the rules of the American Bureau of Shipping, and her hull dimensions are as follows:

Length, over all	600 feet
Length, between perpendiculars	580 feet
Breadth, molded	60 feet
Depth	32 feet

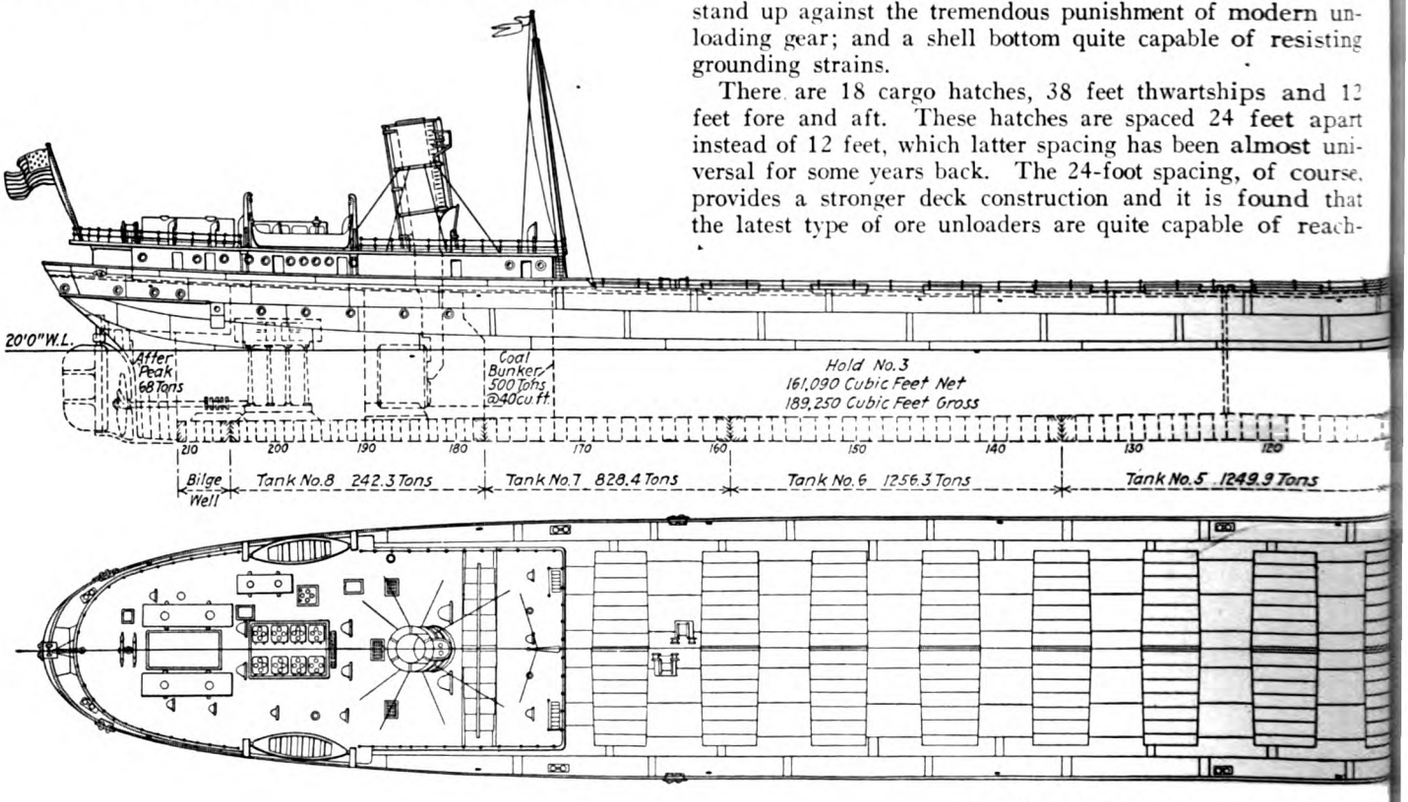
A double bottom is fitted throughout, 5 feet 6 inches deep under the cargo space, and 4 feet 6 inches deep under the engine room; it is divided into sixteen watertight compartments. The cargo hold is divided into three compartments by two screen bulkheads.

The ship has collision, after hold and after peak bulkheads, which are watertight, besides five screen bulkheads. Side tanks are fitted throughout the length of the cargo hold, which is 438 feet long. Each side tank forms one compartment with the double bottom tank in way of it.

The modern type of deep girder construction is carried out, doing away with all stanchions and hold beams, in the cargo space.

The combination type of transverse framing above the double bottom and longitudinal framing in the latter has been adopted as this proves very satisfactory in keeping machinery and other crowded spaces free of deep belt framing and at the same time secures a tank top well suited to stand up against the tremendous punishment of modern unloading gear; and a shell bottom quite capable of resisting grounding strains.

There are 18 cargo hatches, 38 feet thwartships and 12 feet fore and aft. These hatches are spaced 24 feet apart instead of 12 feet, which latter spacing has been almost universal for some years back. The 24-foot spacing, of course, provides a stronger deck construction and it is found that the latest type of ore unloaders are quite capable of reach-



Profile and Deck Plan of 600-Foot Gr

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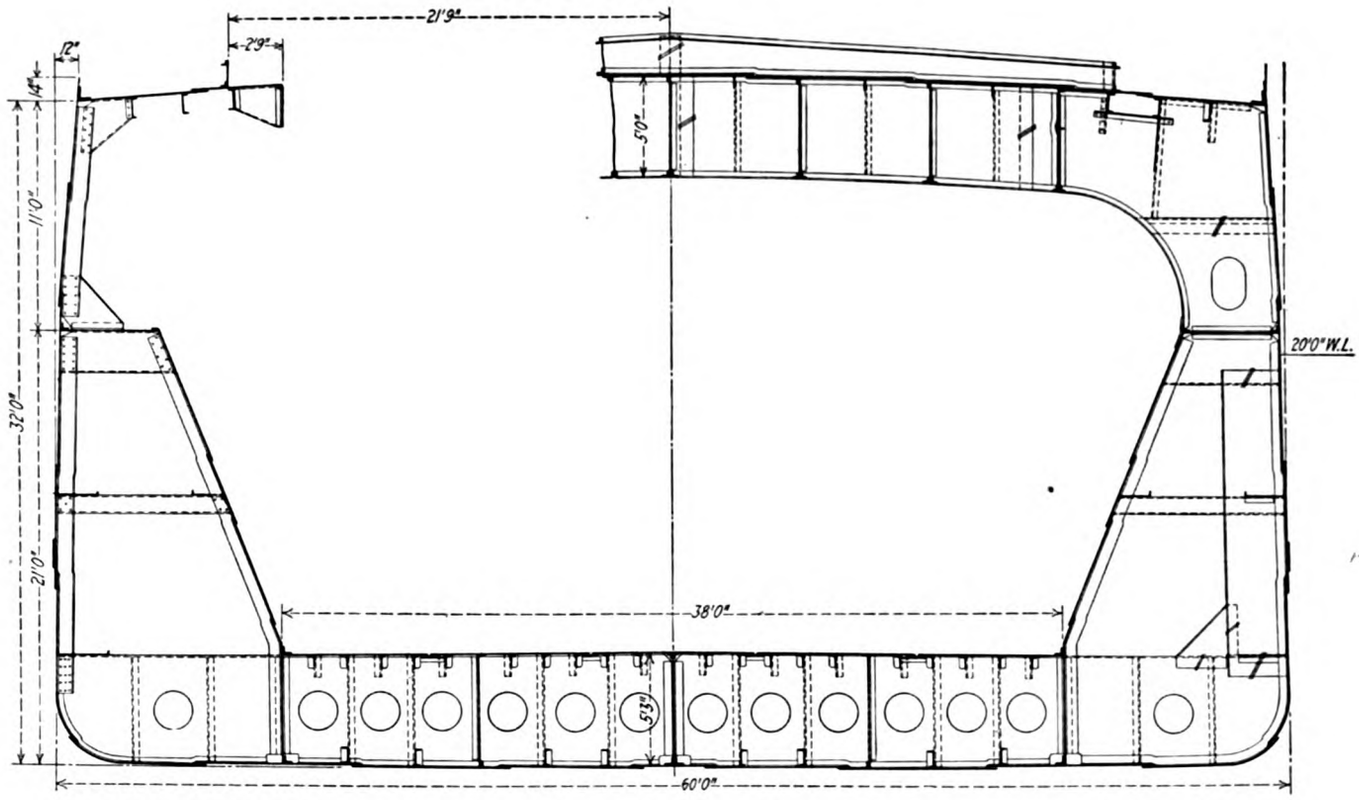


S. S. Charles M. Schwab: Midship Section

ing under the extra deck length in clearing out the cargo.

The general arrangement of the vessel is clearly shown by the accompanying plans. The vessel is equipped with Sperry gyro-compasses.

MACHINERY

The propelling machinery for this ship, built and classified under the American Bureau of Shipping, consists of one triple expansion engine. The low pressure cylinder is forward, the intermediate aft and the high pressure in the center, with valve looking to starboard side to save space fore and aft.

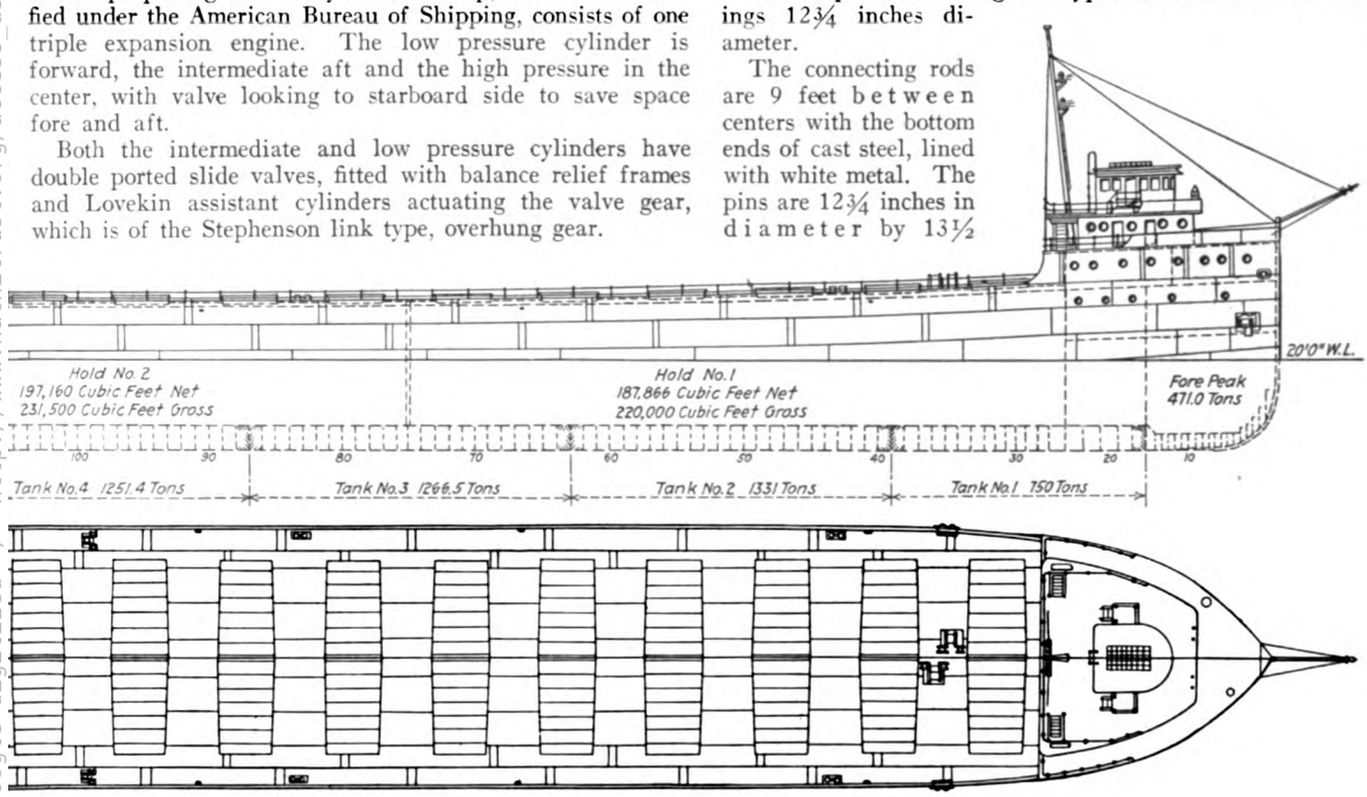
Both the intermediate and low pressure cylinders have double ported slide valves, fitted with balance relief frames and Lovekin assistant cylinders actuating the valve gear, which is of the Stephenson link type, overhung gear.

The high pressure cylinder has a piston valve and is connected to the boilers with a 9-inch throttle valve.

The engine is arranged with three heavy back columns which carry the slipper guides and four front columns. This arrangement gives easy access to the cranks and connecting rods.

The bedplate is of the girder type and has four main bearings 12¾ inches diameter.

The connecting rods are 9 feet between centers with the bottom ends of cast steel, lined with white metal. The pins are 12¾ inches in diameter by 13½



...es Freighter Charles M. Schwab

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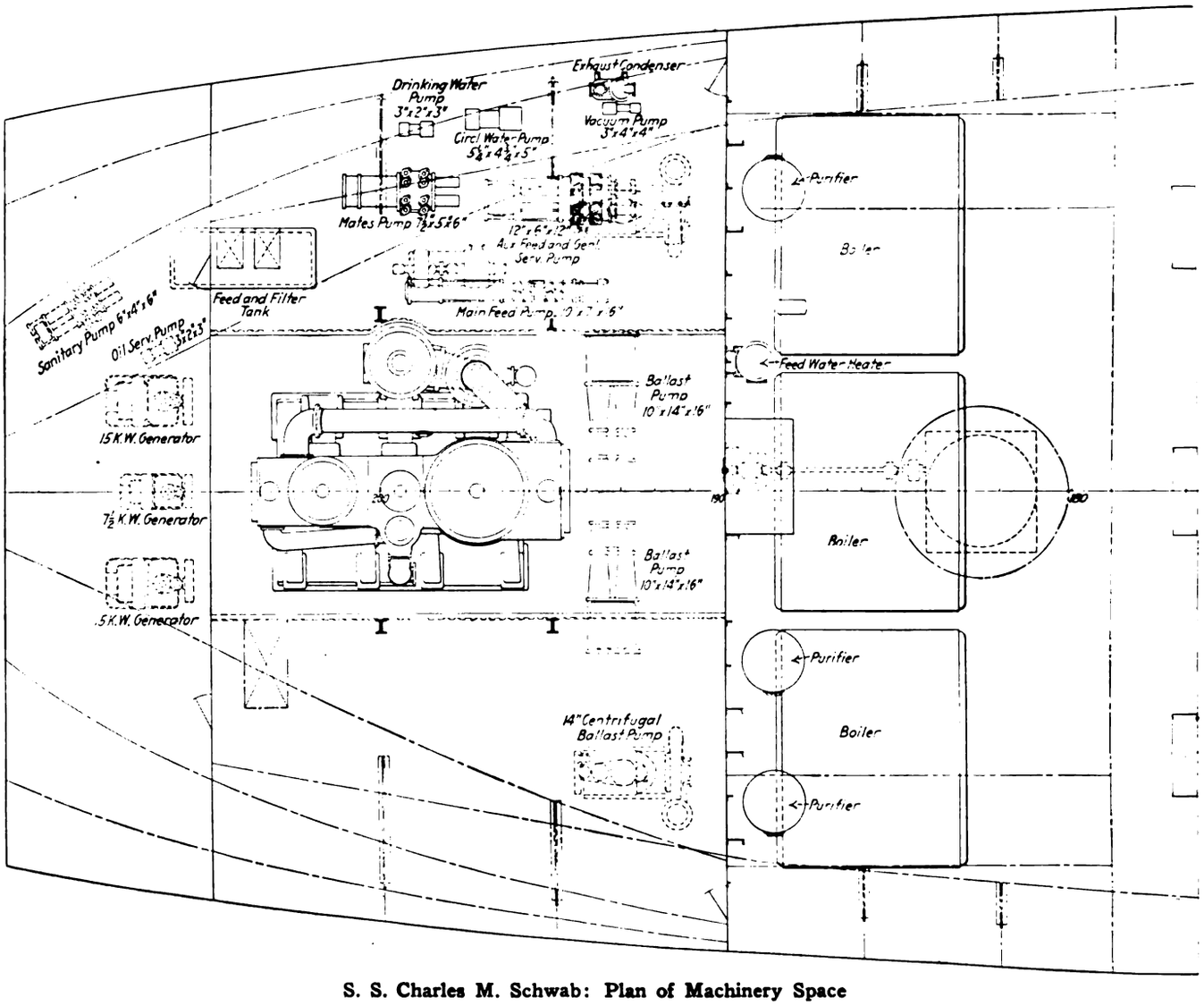


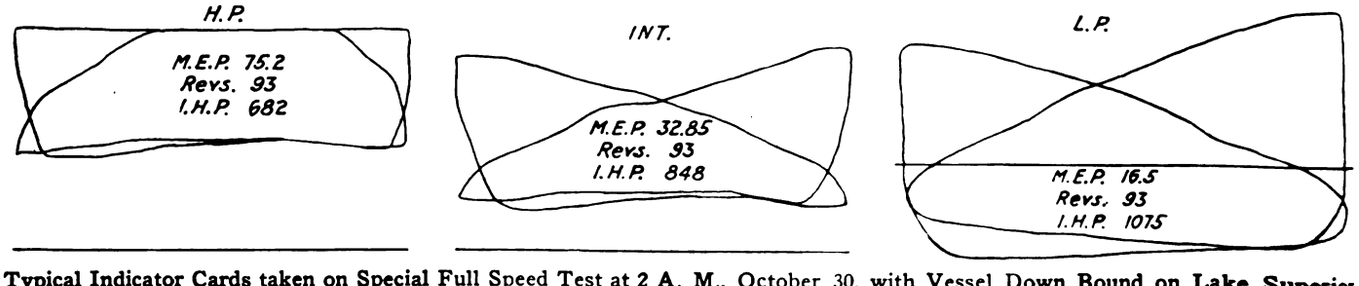
S. S. Charles M. Schwab: Plan of Machinery Space

inches long. The top ends have a single eye and a wedge adjustment which is very much used on the Great Lakes where little time is available for taking up connections.

The crossheads are steel castings with brass slipper guides; the ahead face is lined with white metal. The crosshead pins are 7½ inches in diameter by 10 inches long and are of the best steel, in bronze bearings.

The air pump is of the Edwards patent type, attached to the high pressure engine; its dimensions are, diameter 37 inches by 15 inches stroke. It is connected by channel plate to a special jet condenser equipped with spray nozzles.

In addition to the regular air pump and condensing equipment, this engine is provided with two rado-jets for air ejection and one Terry turbo centrifugal tail or wet pump for condensate. A feed and filter tank is also furnished. This amounts to an independent pumping outfit which can be used in port or when the vessel is maneuvering, or in the event of failure of the main air pump. A practical demonstration was made on the steamer *R. V. Lindabury,* a similar ship, on a trip from Detroit to Lorain. The air pump was entirely disconnected and the auxiliary vacuum augmenter and tail pump maintained a vacuum of 20 inches for the trip, showing this arrangement to be very reliable in case of accident to the air pump. This system, which was designed by the American Ship Building Company's engineers, in collaboration with the Wheeler Condenser and Engineering Company, of Carteret, N. J., has now become very popular with the lake engineers.



Typical Indicator Cards taken on Special Full Speed Test at 2 A. M., October 30, with Vessel Down Bound on Lake Superior, Loaded: Throttle Pressure, 180 Pounds; First Receiver Pressure, 74 Pounds; Second Receiver Pressure, 19.75 Pounds; Vacuum, 23¾ Inches; Total Indicated Horsepower, 2,605; Log Speed, 12.65 Miles Per Hour.

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General Data: Great Lakes Freighter Charles M. Schwab

General Information

Service: Bulk freight.
Builder: American Shipbuilding Co., Cleveland, Ohio.
Owner: Pickands Mather Co., Cleveland, Ohio.

Characteristics

Length, overall	600' 0"
Length, B. P.	580' 0"
Breadth, molded	60' 0"
Depth, molded	32' 0"
Draft, loaded	20' 6"
Draft, light	6' 1"
Block coefficient	.874
Midship section coefficient	.99
Longitudinal coefficient	.883
Speed, loaded, knots	12.3 miles
Framing	Isherwood bottom and deck transverse side

Tonnages

(In tons of 2,240 pounds)

Weight of hull	4,400
*Weight propelling machinery	433
Displacement	17,000

(In tons of 100 cubic feet)

Gross register	7,935
Net register	6,206

*Weight of hull includes hull proper, hull fittings, equipment and outfit.
**Weight of propelling machinery includes engines, boilers (wet), shafting, propellers, and machinery space auxiliaries.

Equipment

Anchors ..... 2 8,000-lb. Bowers stockless
Chain ..... 2¼" stud link

Rudder

Area ..... 185 sq. ft.
Diameter stock ..... 12"

Complement

Deck officers	3
Deck crew	12
Engineer officers	4
Engineer crew	12
Purser's and steward's department	3
Total officers and crew	34

Handling Equipment

	No.	Length
Masts	2	64' fore 62' main

Deck Machinery

Steering gear, 9"x9" shaft controlled, direct acting.
Windlass, 10"x10" spur geared.
Winches, 6 8"x10" single drum mooring, 2 6"x6" hatch.

Life Saving Equipment

Lifeboats	Type	Length
2	Metallic	22' 0"

Propelling Machinery

Boilers

Number	3
Type	S. E. Scotch
Length	11' 0½"
Width or diameter	13' 6"
Furnaces	2 50" Morison
Fuel	Coal
Draft	Ellis & Eaves
Total heating surface, square feet	5,814
Total grate surface	137
Superheat, degrees F	50
Working pressure, lbs. per sq. in.	185

3 Learmont water purifiers.

Engines

Number	One
Type	Inverted recip. triple
Size	24½"—41"—65"x42"
Horsepower, max.	2,400

Propellers

Number	One
Type	4-bladed sectional
Diameter	15'
Pitch	14' 8"
R. P. M., max.	90
Projected area, sq. ft.	73
Developed area, sq. ft.	84

Auxiliary Machinery

Condensers, jet, attached Edwards air pump.
Distiller, Davis Engineering Corp. drinking water.
Filters, 50 gal. capacity.
Feed water heater, Am. Ship. 40,000 lbs. capacity.
Pumps:
2—14" dia. cent. main ballast.
2—10"x14"x16" H.D. aux. ball.
1—14"x7"x16" H.S. main feed.
1—12"x6"x12" H.D. gen. serv.
1—7½"x5"x6" H.D. mates.
1—6"x4"x6" H.D. sanitary.
1—5¼"x4¾"x5" H.D. water.
1—3"x2"x3" drinking water.
1—3"x2"x3" oil to thrust bearing.
1—3"x4"x4" low vac.
1—Cent. Cond. tail pump.
2—Steam jet air pumps.
1—5"x13¼" attached bilge.
1—3½"x13¼" attached cooler.

Refrigerating Machinery

Phoenix motor driven 2-ton ice machine.

Electric Equipment

Generators, 2—15 K.W., 1—7½ K.W.—Engberg.

Holds

No.	Length	Hatches
1	147'	6
2	144'	6
3	150'	6

Capacities

Cargo Space

Compartment	Cu. ft. net	Cu. ft. gross
1	187,866	220,000
2	197,160	231,500
3	161,090	189,250

Bunkers

500 tons.*
*40 cu. ft. per ton.

Tanks

Compartment	Tons F.W.
Fore peak	471
Tank No. 1	750
" " 2	1,331
" " 3	1,293.5
" " 4	1,251.4
" " 5	1,249.9
" " 6	1,256.3
" " 7	828.4
" " 8	242.3
After peak	68
Total	8,715.8

Engineer's Log, S. S. Charles M. Schwab: Down Bound Trip from Duluth to Conneaut; Miles Travelled, 907

Date	Passing Ports and Light-houses	Time Hr.	Min.	M.	Revolutions Register Reads	No. Made	Av. Per Min.	Av. Per Miles	Miles Per Hour	No. Made	Av. Lbs. Steam	Av. Inches Vacuum	Remarks
September 28, 1923..	Leave dock	11	55	P.	110,910	.....	....	...	....	...	185	23	
September 29	O. K. pier	12	55	A.	114,240	.....	....	...	....	...	185	23	Head wind, sea choppy
	Eagle Harbor	5	55	P.	205,260	91,020	89.2	468	11.4	194	185	23	17.00
	Started six hours' test at 7 p. m.												
	Manitou	8	37	P.	219,800	14,540	87.7	440	12.2	33	185	23	2.42
September 30	Caribou Island	2	59	A.	254,510	34,710	90.8	439	12.4	79	185	23	6.22
	Stopped six hours' test at 1 a. m.												
	Started two hours' full gear test at 1 a. m.												
	Stopped two hours' full gear test at 3 a. m.												
	White Fish	7	25	A.	278,600	24,090	90.5	430	12.6	56	185	23	4.26
	Iroquois	9	29	A.	290,040	11,440	92.2	440	12.5	26	185	23	2.54
	Ck'd	(1	10)										
	Soo	10	50	A.	295,515	5,475	67.6	400	10.3	14	185	23	1.21
	Leave Soo	1	20	P.	298,080	.....	....	...	....	...	185	23	[2.30] Delayed
	River ck.		(35)										
	Detour	5	58	P.	320,180	22,100	79.5	442	10.7	50	185	23	4.38, head beam wind and cross seas
	Thunder Bay	11	55	P.	352,110	31,930	89.4	437	12.2	73	185	23	5.57
October 1, 1923.....	Test started	12	00	A.	352,500	.....	....	...	....	...	...	..	
	Test ended	6	00	A.	384,965	32,465	90.1	...	....	...	...	..	
	Harbor Beach	7	32	A.	393,660	41,550	90	461	11.6	90	185	23	7.42
	Lake Huron, L. S.	12	34	P.	420,480	26,820	90.3	447	12.1	60	185	23	4.57
	River ck.		(20)										
	Bar Point	8	30	P.	459,870	11,440	81.7	419	11.7	94	185	23	7.56
	S. E. Shoal	11	45	P.	476,630	16,760	85.9	441	11.8	38	185	23	3.15
October 2	Conneaut	7	50	A.	519,730	43,100	88.8	431	12.4	100	185	23	8.00
	Dock	8	45	A.	520,450	.....	....	...	....	...	...	..	

Down Bound	Hours	Mins.	Down Bound	Hours	Mins.	Miles No. Made	Miles Per Hour	Revolutions Per Min.	Revolutions Per Mile	
Total time at full speed	73	20	From Duluth to Soo	33	55	402	11.8	86	436	
Total time under check	2	05	From Soo to Detour	4	38	50	10.7	79.5	442	Coal used per mile = 371 lbs.
Total time delayed	2	30	From Detour to L. H. L. Ship	17	36	223	12.7	89.9	448.3	
			From L. H. L. Ship to Bar Point	7	56	94	11.75	81.7	419	
			From Bar Point to Conneaut	11	20	138	12.2	87.4	436	
Total time on down trip	77	55	Total running time on down trip	75	25	...	....	..	...	

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Test on S.S. Charles M. Schwab Between Manitou Island and White-Fish Point—Light Head Wind—Sea Choppy

DOWN BOUND—LAKE SUPERIOR, LOADED, SEPTEMBER 29, 1923

Draft for'd = 19' 5" Draft aft = 19' 9" Mean draft = 19' 7"

Time	7:00 P. M.	7:30 P. M.	8:00 P. M.	8:30 P. M.	9:00 P. M.	9:30 P. M.	10:00 P. M.	10:30 P. M.	11:00 P. M.	11:30 P. M.	12:00 M.	12:30 A. M.	1:00 A. M.	Average
Main steam	183	185	183	184	185	185	183	182	185	185	185	182	183	184
Steam at throttle	182	184	182	183	184	184	182	181	184	184	184	181	182	183
Steam at h.p. cyl.	179	180	178	180	180	180	178	178	180	182	181	178	177	179
First receiver	63	63	64	65	65	65	63	65	65	67	65	64	64	64
Second receiver	17	17	17.25	17.5	17.5	17.25	17	17.5	17.5	17.75	17.25	17	17	17
Vacuum	23.75	23.75	24.25	24.25	24.25	24.5	24.5	23.5	23.75	24	24.5	24.5	24.25	24
Back pressure	10.5	7	6.5	6	6	5.5	6.5	6.5	5.5	5.5	5	5.5	6	6
Air press. at fan	1.25	1.25	1.375	1.375	1.375	1.375	1.25	1.25	1.375	1.43	1.43	1.43	1.375	1.38
Rev. counter readings	211,065	213,746	216,464	219,174	221,890	224,579	227,299	229,987	232,690	235,380	238,108	240,802	243,524	
Revs. during run	.....	2,681	2,718	2,710	2,716	2,689	2,720	2,688	2,703	2,690	2,728	2,644	2,722	Total 32,4
Average	.....	89.3	90.6	90.3	90.5	89.6	90.6	89.6	90.1	89.6	90.9	89.8	90.7	90
Revs. by stop watch	91	92	90	91	92	92	91	91	91	91	91	91	92	.....
I.h.p.—h.p.	687	690	680	682	690	675	674	660	672.5	678.9	674	681.9	690	.....
I.h.p.—I.p.	768	787	804	769	815	808	786	785	801.3	789	800	792	777	.....
I.h.p.—L.p.	918	931	939	950	931	950	918	895	921	927	934	915	899	.....
Total i.h.p.	2,373	2,408	2,423	2,401	2,436	2,433	2,378	2,340	2,394.8	2,394.9	2,408	2,388.9	2,366	2,396
M.r.p.	37.03	37.05	38.25	37.45	37.59	37.55	37.03	36.5	37.4	37.4	37.58	37.28	36.5	37.2
Speed from log (miles run)	2.84	9.0	15.1	21.2	27.4	33.4	39.7	45.9	52.1	58.2	64.5	70.6	76.8	.....
Speed from log, per hour		12.2	12.2	12.1	12.4	12.0	12.6	12.4	12.4	12.2	12.6	12.2	12.4	12.3
Slip (figured with revs. from log)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.0
Temp. injection	57	55	54	54	52	52	48	52	51	47	41	43	45	5
Temp. air pump hot well	132	126	124	124	122	118	124	131	128	125	120	120	129	12
Temp. feed and filter tank	134	136	130	130	122	118	117	132	126	123	120	117	119	12
Temp. feed from f.w. heater	200	202	198	198	188	188	184	210	196	190	190	184	190	19
Aver. temp. feed from purifier to boilers	343	342	342	343	339	339	337	345	339	348	338	346	335	34
Temp. superheater outlet aver.	425	423	421	425	422	426	428	426	419	426	428	424	424	42
Temp. saturated steam	380.5	381.4	380.5	381	381.4	381.4	380.5	380.1	381.4	381.4	381.4	380.1	380.5	38
Superheat in degrees	44.5	41.6	40.5	44	40.6	44.6	47.5	45.9	37.6	44.6	46.6	43.9	43.5	4
Temp. boiler room	80	80	80	80	80	80	80	80	80	80	80	80	80	.....
Temp. engine room	80	80	80	80	80	78	77	76	75	74	72	71	71	.....
Main feed pump rev. counter	2,490	3,060	3,620	4,170	4,738	5,276	5,806	6,365	6,887	7,421	7,962	8,489	8,999	.....
Meter, cubic feet	19,108	19,458	19,798	20,138	20,483	20,818	21,143	21,477	21,785	22,110	22,426	22,739	23,054	.....
Lbs. water to boiler by pump	.....	22,002	21,616	21,230	21,924	21,152	20,458	21,576	20,148	20,612	20,882	19,920	19,726	20,8
Lbs. water to boiler by meter	.....	21,840	21,216	21,216	21,528	20,964	20,280	20,242	19,219	20,280	19,718	19,531	19,656	21,0
Lbs. water slip = 2.03%	.....	162	400	14	396	248	178	734	929	332	1,164	389	70	5

Total water fed to boilers by meter in 6 hours = 246,230 lbs. Average per hour = 31,038.6 lbs.

Coal burned in 6 hours	23,783 lbs.
Less 2% moisture	23,308 lbs.
Coal burned per hour	3,884 lbs.
Coal burned per sq. ft. grate per hr.	28.3 lbs.
Coal burned per i.h.p.	1.62 lbs.
Ashes in 6 hours less 5% moisture	2,209 lbs.

Cut off. H.p. 1½ = 68.2 percent. I.p. ¼ = 68.7 percent. L.p. ¾ = 64.7 percent.
Water fed to boilers average per hour = 41,038.6.
Average horsepower = 2,395.7. 41,038.6 ÷ 2,395.7 = 17.1 lbs. p. i.h.p. p. hour, all purposes.
Evaporation for auxiliaries = 4,820.4 lbs. p. hour = 11.7 percent.
Evaporation main engine only calculated = 36,218.2 lbs.
36,218.2 ÷ 2,395.7 = 15.1 lbs. per i.h.p.

AUXILIARIES

Name	Sizs	Steam Press.	Water Press.	Average Strokes and Speed During Test	Steam Consumption	Lbs P. H
Feed pump	14 x 7 x 16	182	217	Working continuously P. S. = 43.3 ft. (stroke made 14").	1.06 x 43.3 x 60 x .427	1,1
Gen. service pump	12 x 6 x 12	182	310	Worked 15 mins. on ashes during test, 26 ft.	1.57 x 26 x 15 x .427	2
Mates pump	7½ x 5 x 6	...	...	Not running.		
Sanitary pump	6 x 4 x 6	136.6	49.3	Continuously, average P. S. = 6.8 ft. per min.	.4 x 6.8 x 60 x .34	
Water circ. pump	5¼ x 4¼ x 5	136.6	42.2	Continuously 30.5 ft.	.3 x 30.5 x 60 x .34	
Vacuum pump	3 x 4 x 4	136.6	2	Continuously 56.9 ft.	.05 x 56.9 x 60 x .34	
Oil pump	3 x 2 x 3	136.6	57	Continuously 4.6 ft.	.1 x 4.6 x 60 x .34	
Generator	7 x 7	81	...	Continuously 390 ft.	.26 x 390 x 60 x .22	1,0
Fan engine	6 x 5	98.9	...	Continuously 191 ft.	.4 x 191 x 60 x .25	1,1
Ballast pump	.....	...	...	Not running.		
Evaporator—estimated	.....	...	...			3
Loss due to condensation, aux'y steam lines, safety valves, whistle, heating system, drains, steam to galley, hot water, etc., estimated.	.....	...	...	Estimated		2
Steering engine, estim'd.	.....	...	...	Estimated		1,0
				Total		4,8

The usual seven collar horseshoe thrust bearing is used, which runs in an oil bath and in addition is lubricated by an independent oil pump forcing in oil at 40 pounds pressure between collars and shoe, which is about the pressure on the driving surfaces. The collars are water cooled inside.

The stern tube is of heavy cast iron made in accordance with the American Ship Building Company's practice, funnel shaped to facilitate removal of the tail shaft inboard for repairs.

The types and dimensions of the auxiliary machinery are given in the table of general data on page 281.

The main ballast pumps are each capable of discharging 6,000 gallons per minute. Water ballast on the Lakes has to be handled very quickly and the water bottom and side tanks in this ship, totaling 8,715 net tons, can be discharged in about four hours.

In extreme weather, when the ship is light, the cargo hold can also be flooded and used as ballast. Two 8-inch filling and suction pipes are connected to the main hold.

The steamer has a cargo capacity, on a draft of 20 feet, of 13,589 short tons of coal, 12,133 long tons of ore or 452,95 bushels of wheat.

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Test on S.S. Charles M. Schwab on Lake Huron Between Thunder Bay and Harbor Beach—Brisk Wind on Starboard Bow and Cross Sea—Ore Cargo, 11,417 Tons

DOWN BOUND—LAKE HURON, LOADED, OCTOBER 1, 1923

Draft for'd = 19' 5" Draft aft = 19' 9" Mean draft = 19' 7"

Time	12 M.	12:30 A. M.	1 A. M.	1:30 A. M.	2 A. M.	2:30 A. M.	3:00 A. M.	3:30 A. M.	4:00 A..M	4:30 A. M.	5:00 A. M.	5:30 A. M.	6:00 A. M.	Average
Main steam at boilers...	183	185	183	183	185	185	185	183	185	182	185	182	182	183.7
Steam at throttle.....	182	184	182	182	184	184	184	182	184	181	184	181	181	182.7
Steam at h.p. cyl'r.....	179	180	180	180	182	182	181	180	180	178	181	178	178	179.9
First receiver.....	62	63	62	62	63	63	63	62	62	61	62	60	60	61.9
Second receiver.....	16	16	17	16	16.25	16.25	16	15.75	16	15.75	16	15.75	15.75	16.04
Vacuum	23.5	23.5	23.5	23.75	23.5	23.5	23.75	23.75	23.75	23.75	23.5	23.5	23.5	23.6
Back pressure.....	6.25	6.5	6.5	11	6	6	6.5	6.5	6	6.5	5.5	7	6.5	6.67
Air press. at fan.....	1½	1¼	1¼	1¼	1⅛	1⅛	1¼	1¼	1⅛	1⅛	1¼	1⅛	1¼	1.27
Rev. counter readings...	352,550	355,258	357,952	360,605	363,332	366,010	368,724	371,402	374,122	376,800	379,536	382,233	384,966	.....
Rev. during run.....	.....	2,708	2,694	2,653	2,727	2,678	2,714	2,678	2,720	2,678	2,736	2,697	2,733	Total revs. 32,416
Average	.....	90.3	89.8	88.4	90.9	89.3	90.5	89.3	90.7	89.3	91.2	89.9	91.1	90.1
Revs. by watch.....	91	91	90	91	90	91	90	91	91	92	92	92	91	.....
I.h.p.—H.p.	766.43	757.57	749.24	753.13	744.86	746.49	758.0	766.43	757.57	761.42	756.94	756.94	757.57	.....
I.h.p.—I.p.	782.59	763.66	742.78	738.42	742.88	763.66	749.02	757.34	757.34	752.9	765.67	752.9	738.42	.....
I.h.p.—L.p.	909.35	893.4	889.9	893.4	899.36	909.35	883.59	909.35	893.4	903.24	919.35	903.24	893.4	.....
Total i.h.p.	2458.4	2414.6	2381.9	2385.0	2387.1	2419.5	2,390.6	2,433.1	2,408.3	2,417.6	2,442.0	2,431.1	2,389.4	2,410.8
M.e.p.	.....	37.97	37.66	38.31	37.29	38.45	37.51	38.68	37.7	38.44	38.02	38.11	37.24	37.96
Miles by log.....	70.80	76.8	82.7	88.7	94.7	100.7	106.7	112.8	118.8	125.0	131.3	137.5	143.8	.....
Speed from log (miles /hour	.....	12	11.8	12	12	12	12	12.2	12	12.4	12.6	12.4	12.6	12.2
Slip. (figured with revs. from log)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.7%
Temp. injection	57	56	56	56	56	56	56	56	57	57	58	59	60	56.9
Temp. air pump hot well	131	129	130	130	131	128	128	128	127	128	129	130	130	129.1
Temp. feed and filter tank	135	127	125	125	127	125	125	125	124	128	126	126	127	126.5
Temp. feed from f.w. heater	201	198	192	193	193	192	195	195	194	208	189	191	191	194.8
Aver. temp. feed purifier to boilers.....	338	339	338	346	346	340	342	346	350	341	350	342	348	344
Temp. superheater outlet aver.	422	428	420	424	430	430	422	428	420	423	428	422	428	425
Temp. saturated steam..	380.5	381.4	380.5	380.5	381.4	381.4	381.4	380.5	381.4	380.1	381.4	380.1	380.1	380.8
Superheat in degrees....	41.5	46.6	39.5	43.5	48.6	48.6	40.6	47.5	38.6	42.9	46.6	41.9	47.9	44.2
Temp. boiler room.....	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Temp. engine room.....	80	81	80	80	81	81	81	81	80	81	81	80	80	80.5
Main feed pump counter readings	11,490	12,050	12,597	13,132	13,670	14,226	15,725	16,225	16,730	17,245	17,780	18,340	18,905	.....
Main feed pump r.p.m...	16	16	18	19	19	18	17	17	19	17	19	19	19	.....
Meter, cubic feet	24,675	25,015	25,350	25,675	26,000	26,330	26,625	26,915	27,215	27,520	27,840	28,175	28,515	.....
Lbs. water to boiler by pump	.....	21,616	21,114	20,650	20,458	21,586	19,418	19,456	19,651	20,040	20,818	21,616	21,808	.....
Lbs. water to boiler by meter	.....	21,216	20,954	20,280	20,280	20,592	18,408	18,096	18,720	19,032	19,968	20,904	21.216	.....
Lbs. water—slip 3.5%...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,565

Total water fed to boilers by meter, 239,666 lbs. in 6 hours. Average per hour = 39,994 lbs.

Coal burned in 6 hours	22,936 lbs.
Less 2% moisture	22,478 lbs.
Coal burned per hour	3,749 lbs.
Coal burned per sq. ft. of grate per hr.	27.3 lbs.
Coal burned per i.h.p.	1.55 lbs.
Ashes in 6 hours less 5% moisture	2,171 lbs.

H.p. cut off 1⅛" = 70 percent. I.p. cut off ¼" = 68.7 percent. L.p. cut off ¼" = 64.7 percent.
Water fed to boilers average per hour = 39,994 lbs.
Average horsepower, 2,410.8. 39,994 ÷ 2,410.8 = 16.5 lbs. p. i.h.p. p. hour all purposes.
Evaporation for auxiliaries = 6,302 lbs. p. hour = 16.0 percent.
Evaporation main engine only calculated 3.18 x 90.1 x 3.5 x 2 x 60 x .70 x .40 = 33,692 lbs.
Evaporation main engine per i.h.p. per hour = 13.9 lbs.

AUXILIARIES

Name	Sizs	Steam Press.	Water Press.	Average Stroke and Speed During Test	Steam Consumption	Lbs. P. Hour
Feed pump	14 x 7 x 16	180	220	Contiauous, at 46.4 ft. per min. (stroke cut to 14")...	1.06 x 46.4 x 60 x .43	1,268
Gen. service pump.....	12 x 6 x 12	180	340	20 min. during test on ashes, 48 ft. per min.....	1.57 x 48 x 20 x .43	648
Mates pump	7½ x 5 x 6	...	...	Not running.		
Sanitary pump	6 x 4 x 6	129	47.6	Continuous ..... 6 ft. per min...	.4 x 6 x 60 x .32	46
Water circ. pump.....	5¼ x 4¾ x 5	129	39.4	Continuous ..... 34 ft. per min...	.3 x 34 x 60 x .32	196
Vacuum pump	3 x 4 x 4	129	2	Continuous ..... 50 ft. per min...	.05 x 50 x 60 x .32	480
Oil pump	3 x 2 x 3	129	68	Continuous ..... 8 ft. per min...	.1 x 8 x 60 x .32	154
Generator	7 x 7	85	...	Continuous ..... 470 ft. per min...	.26 x 470 x 60 x .32	1,613
Fan engine	6 x 5	100	...	Continuous ..... 190 ft. per min...	.4 x 190 x 60 x .26	1,185
Ballast pump	.....	...	...	Not running.		
Evaporator—estimated ...	.....	...	...	.....	.....	262
Loss due to condensation, aux'y steam lines, safety valves, whistle, heating system, drains, steam to galley, hot water, etc., estimated.	.....	...	...	Estimated	.....	250
Steering engine, estim'd.	.....	..	...	Estimated	.....	200
					Total	6,302

BOILERS

Steam is supplied by three Scotch boilers with a total heating surface of 5,814 square feet; the total grate surface is 137 square feet, the ratio of heating to grate surface being 45.5.

Foster type superheaters are used at 50 degrees F. Learmouth water purifiers are connected to each boiler and an American Ship Building Company feed water heater, four pass type, straight tubes, is fitted. Ellis & Eaves induced draft is used, there being one 96-inch diameter fan, driven by a double 6-inch by 5-inch vertical engine, located in the engine room.

The flue blowers are the Brews patent type, direct blowers, located in the breechings, and operated by a rack and pinion from the fire room floor.

TRIALS

While the foregoing description gives a good idea of one of the latest Lake cargo vessels, we believe that our readers will be particularly interested in the unusually complete series of trials which were carried out on this vessel. The complete results of these trials are given in tabular form and are of great interest and value, not only to Lake engineers, but to seagoing engineers as well.

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Two-Hour Full Speed Trial, S. S. Charles M. Schwab, September 30, 1923

DOWN BOUND, LAKE SUPERIOR, LOADED

Draft For'd = 19' 5" Draft Aft = 19' 9" Mean Draft = 19' 7"

Time	1:00 A. M.		1:30 A. M.		2:00 A. M.		2:30 A. M.		3:00 A. M.		Aver	
Main steam at boilers	183		178		185		185		182		18	
Main steam at throttle	182		177		184		184		182		18	
Main steam at h.p. cyl'r	177		174		180		180		178		17	
First receiver	64		72		74		70		70			
Second receiver	17		19		19.75		18.25		18		1	
Vacuum	24.25		24		23.75		23.5		23.5		23	
Back pressure	6		10.5		6		6.5		6.5			
Air pressure at fan	1.375		1.25		1.3125		1.3125		1.25		1	
Revs. of fan	232		222		235		270		233		238	
Rev. counter readings	243,524		246,260		249,043		251,790		254,580			
Revs. during run		2,736		2,783		2,747		2,790				
Average revs.		91.3		92.7		91.5		93			92.1	
Revs. by watch	92		93		93		92		92		92	
I.h.p.—H.p.	690		696		682		688		703		69	
I.h.p.—I.p.	777		834		848		833		834		82	
I.h.p.—L.p.	899		1,022		1,075		972		978		98	
I.h.p.—Total	2,366		2,552		2,605		2,493		2,515		2,59	
M.r.p.	36.5		39		39.8		38.5		38.8		38	
Miles travelled by log	76.8		83.1		89.4		95.8		102.2			
Speed by log, miles per hour		12.6		12.6		12.8		12.8			12	
Slip—											16	

Cut-off: H.p. 0" = 75% I.p. ¼" = 68½% L.p. 1" = 63¼%

Temp. of injection	45°		44		44		46		47		45	
Temp. of hot well	129		128		128		132		132		12	
Temp. of feed and filter tank	119		126		127		128		128		1	
Temp. of feed heater outlet	190		190		194		196		196		19	
Average from purifiers to boilers	335		344		335		344		338		33	
Temp. at boiler outlet	424°		428		424		429		425		42	
Temp. of saturated steam	380.5		378.4		381.4		381.4		380.1		38	
Degrees of superheat	43.5		49.6		42.6		47.6		44.9		4	
Main feed pump double strokes	36		39		37		36		38		3	
Main feed pump counter	8,999		9,579		10,179		10,814		11,302			
Meter readings	23,054		23,414		23,739		24,080		24,459			
Cubic feet by meter		360		325		341		379			3	
Pounds of water by meter		22,464		20,280		21,278		23,650				
Total water fed in 2 hours					87,672 lbs.							
Average water fed in 1 hour					43,836 lbs.							

Evaporation of main engine at 75 percent cut-off and 92.125 revs. = 35,977.5 lbs. per hour
43,836 — 35,977.5 = 7,858.5 lbs. for auxiliaries.
Evaporation per i.h.p. for all purposes = 43,836 ÷ 2,506.2 = 17.4 per i.h.p. per hour.
Evaporation per i.h.p. for main engine = 35,977.5 ÷ 2,506.2 = 14.3 per i.h.p. per hour.

Test Results and Efficiencies, S.S. Charles M. Schwab, from Tabulated Data Taken September 30-October 1, 1923 (2 Tests)

COAL AND ASH ANALYSIS

Valley Camp ¾ Lump Coal from Samples Taken from Bunkers and Analyzed by Chemist.

Average Chemical Analysis Used for Test Figures.

Coal	Fixed carbon	57.07	
	Volatile matter	41.53	
	Ash	8.06	Dried at 212°
	Sulphur	1.41	
	Moisture	.76	
	B.t.u.'s	14,316.	
Ash	Fixed carbon	29.47	
	Volatile matter	2.75	
	Ash	67.77	

For figuring purposes 2 percent moisture is deducted from actual weight of coal burned.

Heat absorbing surface	3 boilers	5,814	sq. ft.
	3 superheaters	1,848	sq. ft.
	3 air heaters	2,937	sq. ft.
	Total	10,599	sq. ft.

Grate surface of 3 boilers	137.1	sq. ft.
Average steam pressure, lbs.	183.5	
Average revolutions per min.	90.1	
Average i.h.p.	2,403.2	
Average m.r.p. to l.p. cylinder	37.61	
Average speed in miles per hour	12.25	
Average temperature of feed water, degrees	194.2	
Average superheat, degrees	43.6	
Average water fed to boilers per hour, lbs.	41,622.8	
Factor of evaporation	1.06	
Equivalent evaporation	44,120.1	
Average coal burned per hour less 2 percent, lbs.	3,893.	
Average ashes per hour less 5 percent, lbs.	365.	
Average combustible per hour, lbs.	3,528.	
Average coal burned per i.h.p., lbs.	1.59	
Average combustible per i.h.p., lbs.	1.44	
Average coal burned per sq. ft. of grate per hour, lbs.	28.3	
Average evaporation per lb. of coal	10.7	
Equivalent evaporation per lb. of coal	11.3	
Average evaporation per i.h.p. all purposes	17.3	
Equivalent evap. per i.h.p. all purposes	18.3	
Average evaporation of main engine only per hour	34,655.	
Average evaporation of auxiliaries per hour	5,561.	
Average evaporation per i.h.p. per hour of main engine	14.5	
Average evaporation per sq. ft. of heating surface	7.16	
Equivalent evap. per sq. ft. of heating surface	7.5	
Average evaporation per sq. ft. of grate surface	303.	
Equivalent evap. per sq. ft. of grate surface	322.	
Boiler heating surface per i.h.p.	2.41	
Superheater surface per i.h.p.	.76	
Air heater surface per i.h.p.	1.22	
Total heat absorbing surface per i.h.p.	4.41	
I.h.p. per sq. ft. of grate surface	17.5	
Gas per lb. of coal	22.	
Temperature of air entering furnace	208.	
Temperature of fire room	80.	
Temperature rise from air heater	128.	
Assume half air from heater and half from fire-room, then total rise per lb. of coal	1,408.	
Added to air from each pound of coal	337.9	B.t.u.
Efficiency of boilers alone	77.4	percent
And superheaters	79.5	percent
Superheaters and air heaters	81.4	percent

It is not often that such comprehensive tests are carried out or even attempted. As we have often pointed out, the value of such work to shipbuilders and operators can hardly be over-estimated and we feel sure that our readers will appreciate the courtesy of the owners and builders of the *Charles M. Schwab*, and especially of J. C. Workman, chief engineer of the American Ship Building Company, and Captain Walter E. Stewart, marine superintendent, and Charles E. Collins, chief engineer, of the Interlake fleet, to whom we are indebted for this information.

U. S. Chamber of Commerce to Discuss Section 28 at Annual Meeting in Cleveland This Month

A DISCUSSION of Section 28 of the Merchant Marine Act of 1920, providing for preferential rail rates on export and import commodities carried in American ships will take place at the forthcoming annual meeting of the Chamber of Commerce of the United States at Cleveland, O., on May 6 to 8. This and other merchant marine questions will be given consideration at a transportation group session. Representatives of leading industries of the country engaged in the export and import business will participate in the discussion.

Admiral L. C. Palmer, president of the Fleet Corporation, will address this group meeting on the "Merchant Marine Program." Another speaker will deal with the subject of "Inland Rail Rates in Relation to Ocean Transportation."

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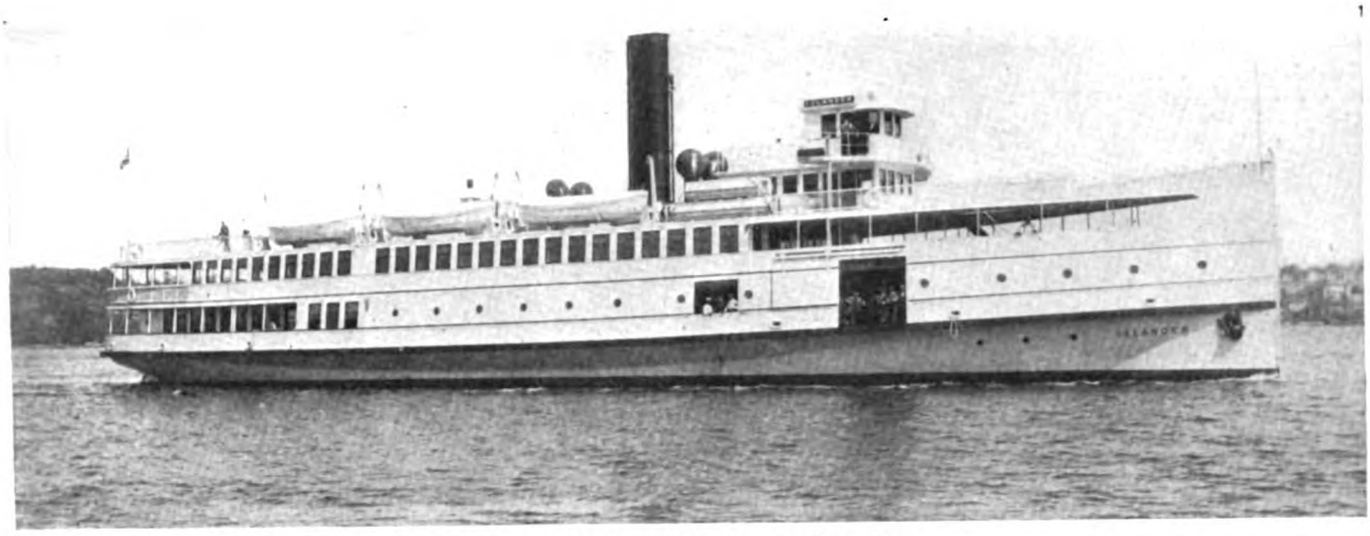


Fourteen-Knot, Steel Steamer Islander

New Steamer for New Bedford-Nantucket Service

Fourteen-Knot Steel Steamer Islander Built at Bath for New England Steamship Company—Exceptionally Complete Trial Data

A VERY notable recent addition to the fleet of smaller American coastwise steamers is the *Islander,* completed last August by the Bath Iron Works, Bath, Me., for the New England Steamship Company, New York.

The general design of the *Islander* was prepared by the owners' technical staff under the direction of Mr. Warren T. Berry, their superintendent of marine construction, and the details of construction were developed by the owners in conjunction with the engineering staff of the Bath Iron Works.

Built for continuous service in all weathers between New Bedford, Mass., and the islands of Martha's Vineyard and Nantucket, the conditions of operation were unusually exacting and the success with which they were met and overcome is amply evidenced by the very satisfactory manner in which the vessel has performed since entering service last fall.

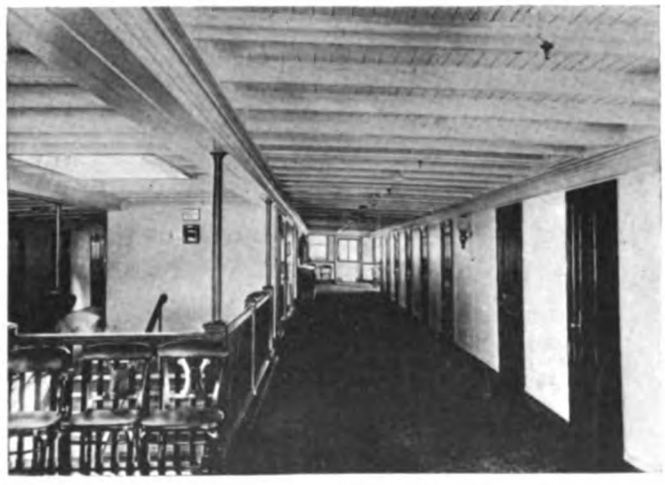
The designers were called upon to provide accommodations for a large number of deck passengers, freight capacity of 150 tons and deck space with large side ports for automobiles. A sustained speed of 14 knots was required on a rather limited draft, and the severe weather conditions often experienced off the south coast of Cape Cod made seaworthiness of prime importance. It was furthermore decided to make the vessel as nearly fireproof as the other conditions to be fulfilled would permit.

Main Particulars

The general dimensions and particulars of the *Islander* are as follows:

Length overall	210	feet
Length between perpendiculars	202	feet
Breadth over guards	50	feet
Breadth molded	36	feet
Depth molded	14	feet 6 inches
Load draft	9	feet 3 inches
Load displacement	882	tons
Load block coefficient	.459	
Tonnage:		
Gross	1,089	
Net	456	

Lounge and Writing Room



Corridor on Saloon Deck

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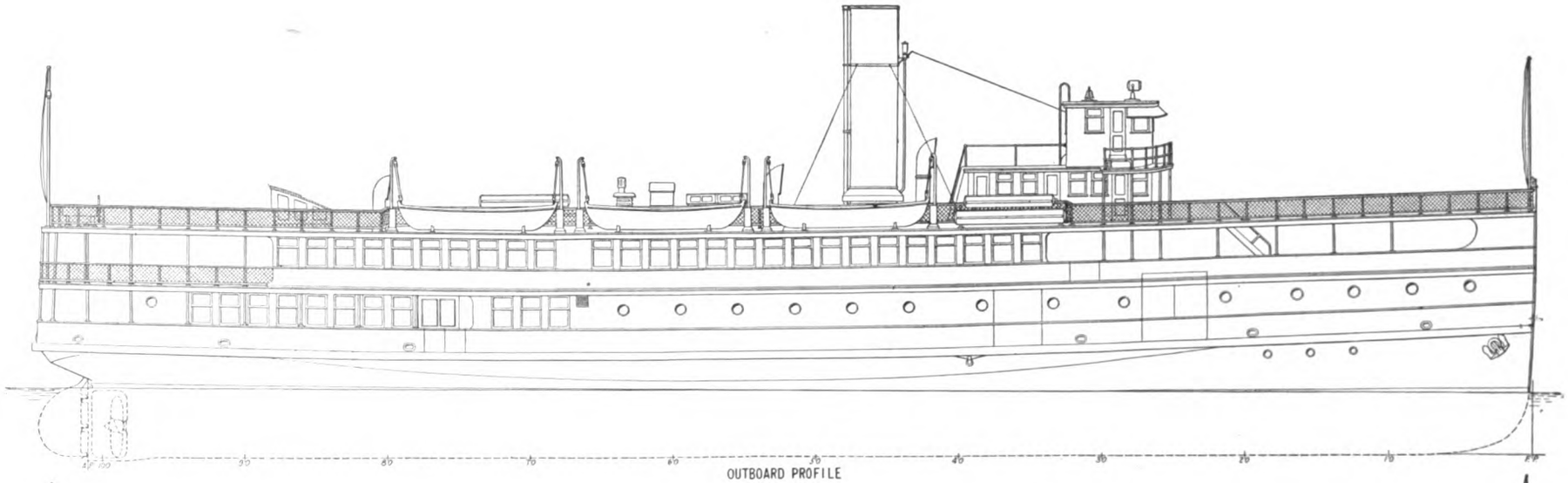
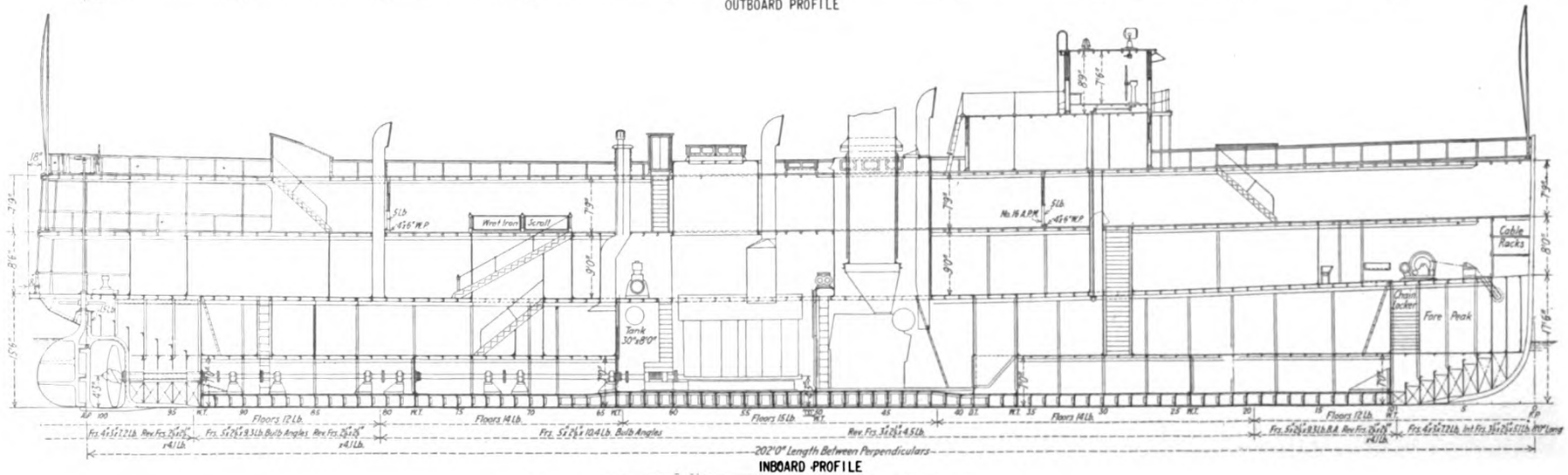
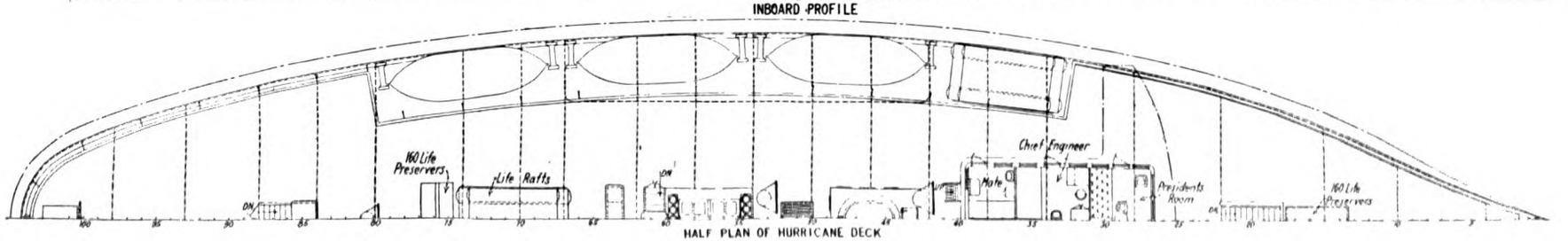


OUTBOARD PROFILE



INBOARD PROFILE



HALF PLAN OF HURRICANE DECK

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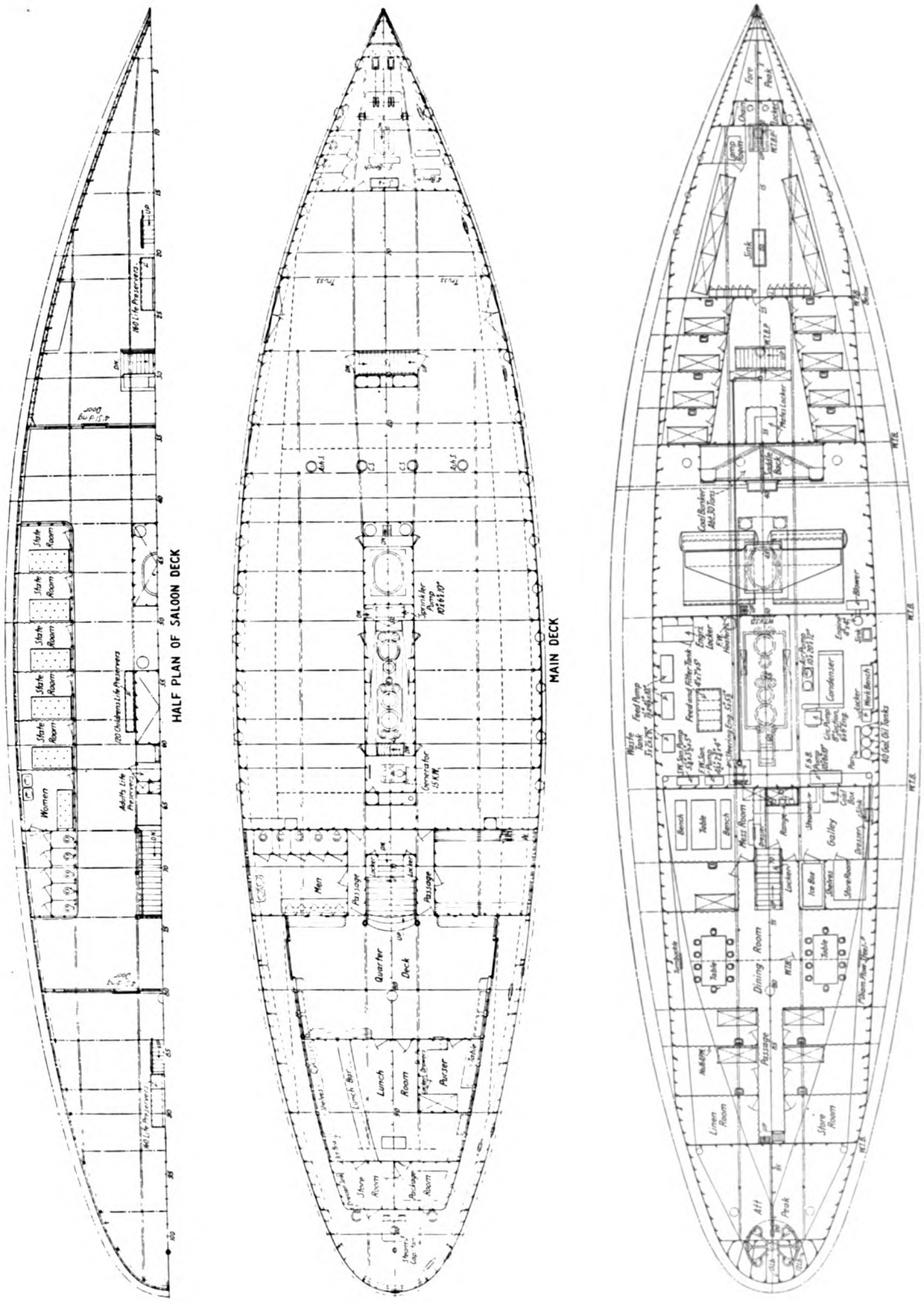

S. S. Islander: Outboard and Inboard Profiles and Deck Plans

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Cargo capacity	34,000 cubic feet
Bunker capacity (coal)	20 tons
Passenger capacity:	
Winter	230
Summer	1,960

The entire vessel is constructed of steel, with the exception of the carlines and decking of the saloon and hurricane decks and the pilot house, bridge and officers' quarters immediately aft, the latter, for navigational reasons, being constructed of wood.

As shown by the plans, the vessel has unusual watertight subdivision for her class. There are nine transverse watertight bulkheads in all and forward and aft of the machinery spaces watertight flats are fitted, forming tanks four feet deep.

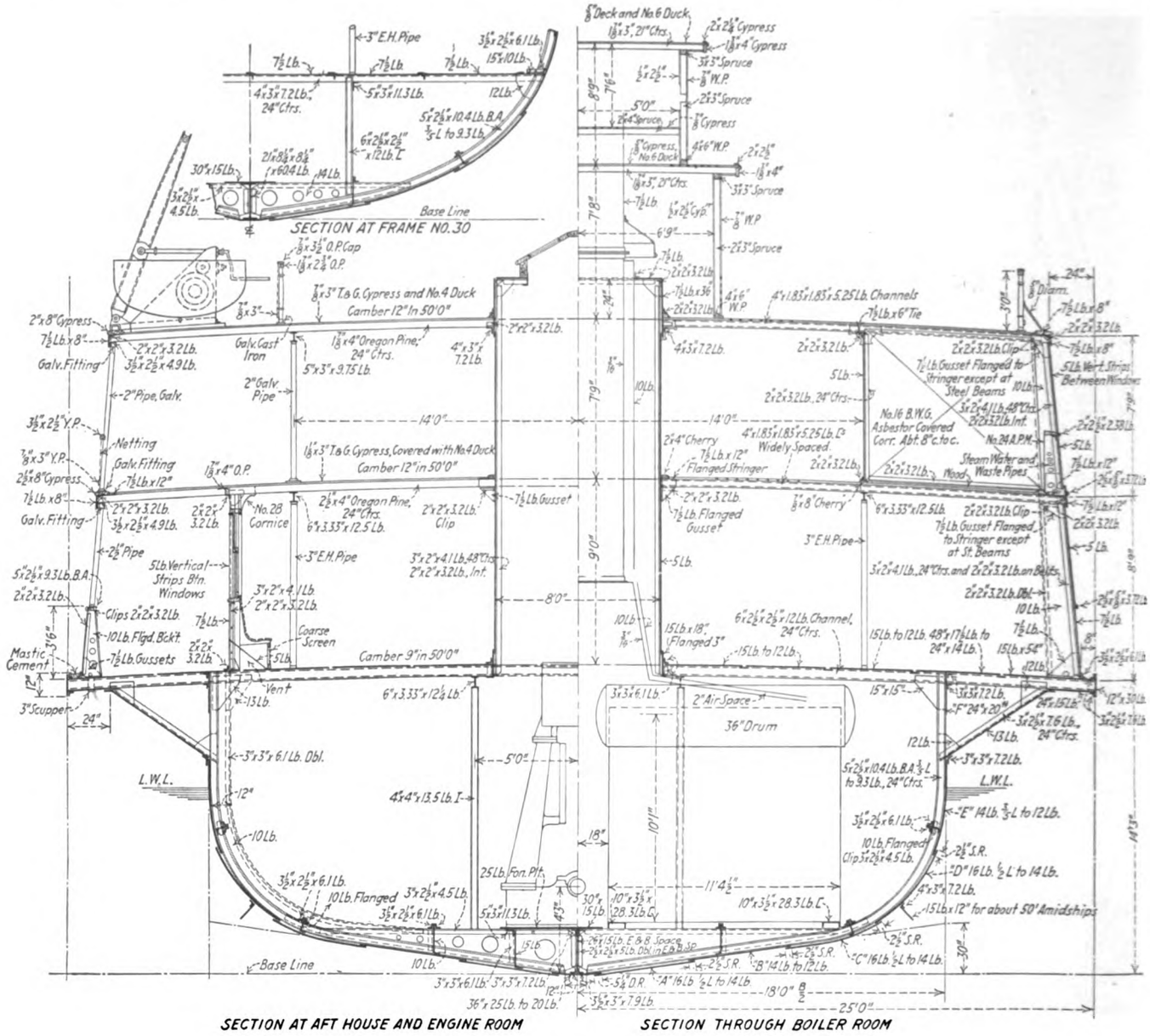
Fireproof Construction

Every effort has been made, with proper consideration for service requirements, to produce a vessel as nearly fireproof as possible. No wood enters into the construction below the main deck, other than doors to rooms. Above the main deck the house sides, bulwarks, divisional and stateroom bulkheads and stairs are entirely of steel.

All electric wiring is run in conduit and all fixtures below the main deck, as well as outside fixtures, are watertight.

Automatic sprinklers, together with a corresponding thermostatic fire alarm system, are fitted throughout the interior of the vessel.

While the *Islander* is designed for carrying deck passengers only, there are thirteen day parlor rooms on the saloon deck fitted with couches and chairs and supplied with running water.



S. S. Islander: Midship Section

Propelling Machinery

The propelling machinery consists of one four-cylinder, triple expansion engine, of 1,200 indicated horsepower at 200 revolutions per minute. The cylinders' diameters are 16, 26, 30 and 30 inches and the stroke 24 inches. The engine is balanced on the Yarrow-Schlick-Tweedy system and was designed and built by the Bath Iron Works. Steam is supplied at 200 pounds per square inch working pressure by two Babcock & Wilcox watertube boilers, arranged for burning coal. The total heating surface of the boilers is 4,500 square feet and the total grate area 130 square feet, making a ratio of heating surface to grate area of 35 to 1.

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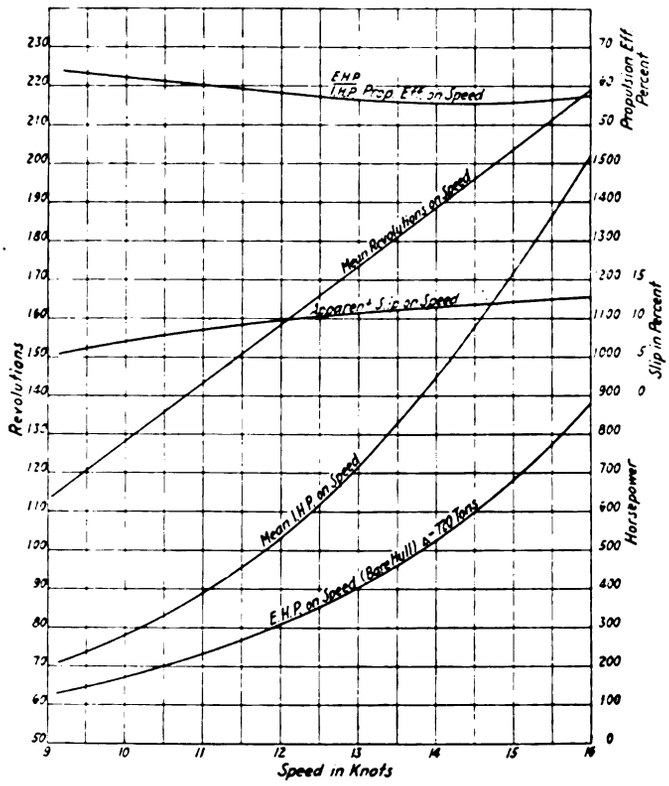
Propulsion is by a solid, four-bladed bronze propeller 8 feet 6 inches diameter, 8 feet 6 inches pitch and with a projected area of 3,312 square inches.

AUXILIARIES

The following is a list of all the auxiliary machinery fitted:

One 15-kilowatt generating set, General Electric Company.
One windlass, 6-inch by 6-inch engine, Hyde Windlass Company.
One capstan, 4½-inch by 6-inch engine, Hyde Windlass Company.
One steering engine, 5-inch by 5½-inch, Hyde Windlass Company.
One air pump, 9-inch by 20-inch by 12-inch, vertical, single acting, twin beam Worthington.
One sanitary salt water pump, 5¼-inch by 4¼-inch by 5-inch, duplex Worthington.



Performance Curves of S. S. Islander

One sanitary fresh water pump, 4½-inch by 3¾-inch by 4-inch, duplex Worthington.
One fire and bilge pump, 10-inch by 6-inch by 10-inch, duplex Worthington.
One sprinkler pump, 10-inch by 6-inch by 10-inch duplex Worthington.
One main feed pump, 10-inch by 6-inch by 12-inch simplex Warren.
One auxiliary feed pump, 10-inch by 6-inch by 12-inch simplex Warren.
One condenser, 1,500 square feet condensing surface.
One circulator pump, Bath Iron Works type, 9-inch suction and discharge, 7-inch by 5-inch engine.
One feed water heater, Bath Iron Works type.

All valves and pipe fittings, with the exception of a few special valves, as well as all the plumbing fixtures, were furnished by the Crane Company.

TRIAL DATA

The *Islander* was given a very thorough trial on July 24, 1923, including standardization runs over the measured mile, the results of which are shown by the accompanying curves. The mean of the four highest runs was 15.5 knots, the corresponding revolutions being 211.

It will be noted from the trial curves that the model of the vessel had been tested in an experimental tank, thus making it possible to determine the propulsive efficiency for the different speeds, and giving a complete and most valuable record of performance. The obtaining of complete and reliable data of this sort is unusual in merchant vessels. In the present instance it is but an additional indication of the thoroughness and care which characterizes all the work of both the designers and builders of the *Islander*.

Electrolytic System for Preventing Corrosion in Boilers and Condensers

TWO systems of protecting boilers and condensers from corrosion by applying the principles of electrolytic action are now in use. The following description deals with the new Kirkaldy system in which electrolytic conductivity is produced in the water by supplying a current of electricity from a source of supply outside the boiler or condenser to metallic anodes insulated from the boiler or condenser shell. This is unlike the slab method of electrolytic protection which utilizes the current of electricity created within the boiler or condenser itself by the galvanic action which takes place between the boiler or condenser shell and zinc or steel slabs constituting anodes.

FUNCTIONING OF THE KIRKALDY SYSTEM

In overcoming the effect of corrosion, the Kirkaldy system works as follows:

A low tension direct current of small amperage supplied from a secondary battery or a current generator is led to metallic anodes submerged in the boiler or condenser circulating water, the anodes forming the positive pole of the circuit. The anodes and the electrical connections to them must at all times be insulated from the boiler or condenser shell.

By the continuous supply of a positive current of electricity to these boiler or condenser anodes, the latter become the positive or wasting pole and the boiler surfaces, condenser tubes, etc., the negative or non-wasting pole of the electrolytic circuit thus produced. Under these conditions, continuous electro-chemical interchanges and combinations take place between the iron of the anodes and the absorbed oxygen in the boiler or condenser circulating water or the oxygen contained in the chemical impurities of these waters which would otherwise produce hard scale.

The constant supply of current to the anodes stimulates this action and causes continual absorption by the anodes of the corrosive and scale forming properties of the water impurities thereby giving to the boiler surfaces, condenser tubes, etc., protection against corrosion.

The boilers and condensers, therefore, with their contents may be compared to a huge electrolytic cell in which the oxygen, acids and other corrosive impurities held in suspension or solution in the water are attracted to the anodes and chemically disintegrated before being able to exercise their corrosive influence, whereas the hydrogen liberated and collected by the negative immersed boiler and condenser surfaces effectively protects them from harmful scale and corrosive adhesions.

When using this system, it is of vital importance that there should be no reversal of current or polarity; that is, the anodes must always be electro-positive and the boilers and condensers electro-negative, otherwise the anodes would be protected and the boilers and condensers attacked. With this object in view and to prevent the reversal of flow of current from any cause while the system is in use, a reverse current coil is inserted in the main circuit and, should the flow of current be reversed, this coil automatically operates to break the supply circuit.

The American rights for this system are controlled by the Kirkaldy Engineering Corporation, 52 Vanderbilt avenue, New York.

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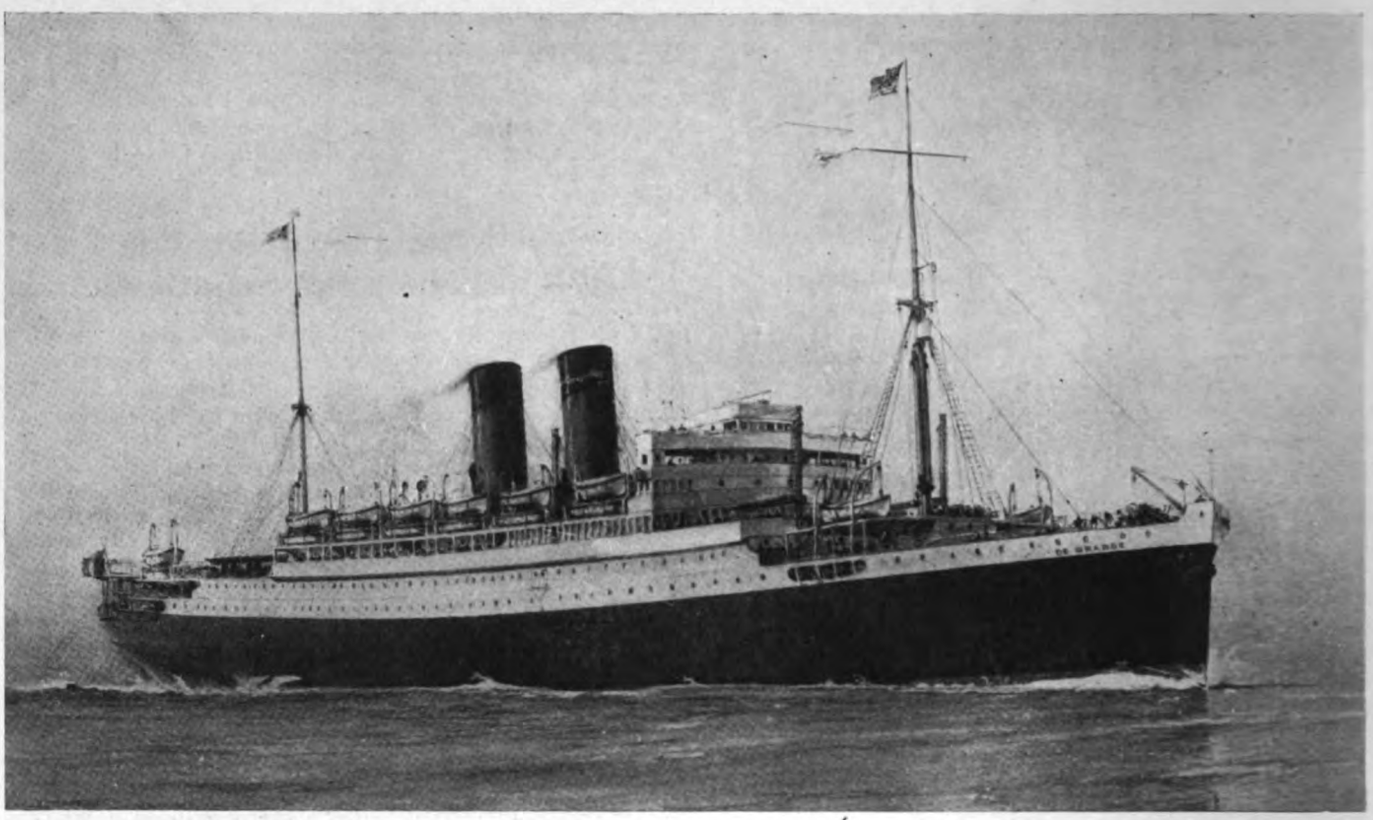

French Liner De Grasse, of 17,000 Gross Tons, Which Will Enter Havre-New York Service in July

New French Liner De Grasse

By Our Paris Correspondent

THE Compagnie Generale Transatlantique (French Line) will take delivery in July, 1924, of their new passenger steamer *De Grasse,* which is to be placed in service as a cabin vessel on the Havre-New York line.

The *De Grasse* is 550 feet long, 71 feet beam, 46 feet 6 inches deep and has a displacement of 21,700 tons at 28 feet draft. Her approximate gross tonnage is to be 17,000 tons. The vessel has been built to the highest class of the Bureau Veritas and also complies with the requirements of the International Convention and with the French, British and American Government emigrant regulations for a passenger and cargo steamer. She is also to have the British Board of Trade passenger certificate.

There are 4 complete decks with a long combined bridge and forecastle deck and an orlop deck forward of the boiler room. There is a large central superstructure with a boat deck and bridges above. The captain's room is in a deckhouse on lower bridge. The officers' and wireless rooms and the gymnasium are arranged in a deckhouse at the forward end of the boat deck.

The hull is divided into 12 watertight compartments and there is a cellular double bottom extending the full length of the ship, arranged for carrying oil fuel, fresh water and water ballast.

Passenger accommodations are provided as follows:

398 cabin class passengers (72 one-berth cabins, 103 two-berth cabins, 28 three-berth cabins, 18 two-berth cabins with private bath rooms).

54 alternate cabin class or third class cabins (15 one-berth cabins, 6 two-berth cabins and 9 three-berth cabins).

762 third class cabins.

914 third class in open berths.

46 alternate third class or firemen.

The number of officers is to be 23, and the crew totals 253.

All staterooms of the cabin class are fitted with running hot and cold water and a large number of staterooms have private bath rooms. Running water is also fitted in third class cabins and passengers of that class have at their disposal two large dining saloons, a lounge and a smoking room.

The propelling machinery of the *De Grasse* will consist of two sets of turbines with single reduction gearing. The complete turbine installation is capable of developing a collective horsepower of about 11,500 with the revolutions of the propeller shafts about 105 per minute. Steam will be supplied by 10 single ended cylindrical boilers fitted with Howden forced draft and arranged for oil burning on the Wallsend-Howden system.

There will be two refrigerating machines of the Hall CO_2 type. A refrigerated cargo hold is to be installed, in addition to the refrigerated storerooms.

The *De Grasse* will be the first new liner placed into service by the C. G. T. on the Havre-New York line since the advent of the *Paris* in June, 1921. The next vessel will not be completed before 1927.

GERMAN SHIPPING TONNAGE.—According to figures recently published in Germany the six leading German steamship companies have a combined gross tonnage of approximately 1,250,000. Of this total two-thirds has been built since the war, Consul Albert H. Gerberich, reports from Bremerhaven, February 6. Comparative figures are as follows:

	1907	1913	1923
Hamburg-American Line	955,742	1,360,360	384,734
Norddeutscher Lloyd	804,060	982,951	279,713
Deutsch-Austral and Kosmos	308,351	527,718	173,583
Hansa	244,985	440,544	148,993
Hamburg-Sud Amerika D. G.	197,600	384,982	129,464
Hugo Stinnes Lines	.....	30,052	125,083
Totals	2,510,738	3,726,607	1,241,570

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Diesel Machinery for 20,000-Ton Passenger Liner

Details of Quadruple Screw 13,000 Brake Horsepower Installation— A New 2,000 Brake Horsepower Two Cycle Six Cylinder Engine

By Our Special London Correspondent

THE 20,000-ton motor passenger liner *Aorangi* which is being built for the Union Steamship Company and will be placed on the Pacific run between Vancouver and Australian and New Zealand ports, will be the first big oil engined vessel of this class to be placed in commission. She is under construction on the Clyde at the Fairfield yard and according to present arrangements, trials will be run in December of this year.

The *Aorangi* will be 600 feet in length and will carry approximately 1,000 passengers, in addition to about 3,100 tons of cargo, and fuel to the extent of some 3,000 tons. She is scheduled to maintain a speed at sea of 17¼ knots and it is expected that on trials 18 knots will be exceeded. The power needed is about 13,000 shaft horsepower, which is achieved by the employment of a quadruple-screw installation, each engine developing normally 3,250 brake horsepower at 125 revolutions per minute. with an overload capacity up to approximately 20 percent.

3,250 B. H. P. Sulzer Type Engine

The first engine has just been tested in the Fairfield shops and the event has aroused the greatest interest in shipbuilding and engineering circles in the United Kingdom. The motors are of the well-known Sulzer design, with certain modifications, but they have been built by the Fairfield Company. They are the highest-powered marine oil engines yet constructed, but the size will shortly be eclipsed on the completion of the 6,750 brake horsepower Burmeister & Wain double-acting four-cycle engines to be installed in the 17,000-ton motor liner *Gripsholm* for the Swedish-American Line.

Each engine has six cylinders, the bore and stroke being 27½ inches and 39 inches respectively. In view of the controversy concerning the mean effective pressure that may be used in Diesel engines for continuous service, it is interesting to note that a figure of about 88 to 90 pounds per square inch is adopted in this instance. This may be taken as about normal. The question of weight is also of importance. The four engines will in all weigh about 1,150 to 1,200 tons exclusive of auxiliaries. This is a fairly substantial figure, but the builders claim that they have adopted a conservative policy in this direction with a view to preventing any possibility of vibration; had there been any absolute necessity for weight cutting, they could have reduced each engine by about 30 tons.

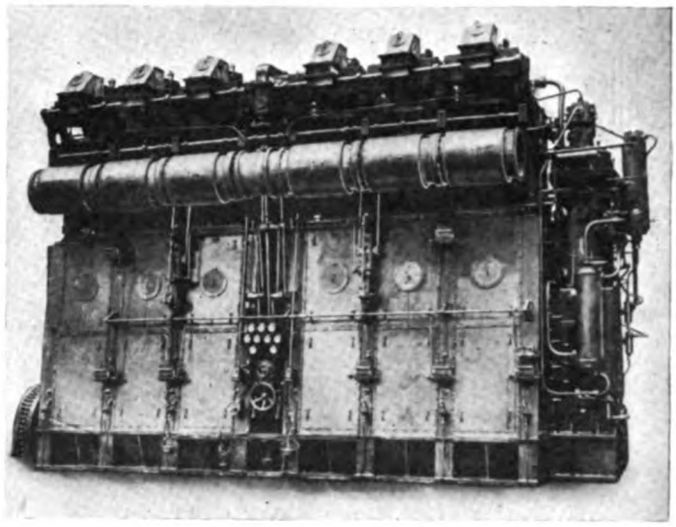
Control Gear

In the Sulzer type of motor all the main gear is at the top of the engine and the designers have taken the view that it is only consistent for the controls to be arranged at a similar level. All the reversing and control mechanism is therefore located at the forward end of each engine and it is the intention for one attendant to control each pair of engines, which incidentally are arranged in line, so that there is direct access from one control station to the other, along a grating. As the necessity may arise to stop all four engines at once when the engineer may be on the engine room floor level, a lever is arranged at this level by which all the machinery may immediately be brought to a standstill by shutting off the fuel.

The system of independent drive to all auxiliaries has been employed and on each engine there is no accessory, apart from two vertical three-stage injection air compressors at the forward end and a small crosshead lubricating pump the purpose of which is to supply lubricating oil at a pressure of about 250 pounds per square inch to all the crossheads. There is no scavenging pump in the ordinary sense, the scavenging air being supplied from electrically driven blowers. These are coupled to electric motors of about 400 horsepower and one unit supplies sufficient air for the two engines at a pressure of under two pounds per square inch. It is interesting to note that the power required for this purpose for each engine is between 150 and 175 brake horsepower, the blowers rotating at the high speed of 2,500 revolutions per minute.

New Design of Scavenging Valve Adopted

It is well known that in the Sulzer engine there is a row of super-imposed scavenging ports above the main ports, these being valve controlled and permitting of the admission of a super-charge of air. In the ordinary way the valves are of the semi-rotary type, one for each cylinder, and they are, of course, arranged within the scavenging trunk, driven by a long horizontal shaft operated from the vertical governor shaft. In the new engine all of this gear is eliminated and the valves are of the automatic type consisting of light plate disks. It is understood that this design will in future be a standard for all Sulzer motors.



New 2,000 Brake Horsepower Neptune Two Cycle Diesel Engine

There is no occasion to describe the rest of the engine in detail, since it follows along normal lines. A 3½ days' nonstop trial was held and the fuel consumption worked out at 0.392 pound per brake horsepower hour, but this does not include the amount of fuel required for the turbo blower, which, if added, would bring the figure up to about 0.41. For 12 hours the engine maintained an overload of 12 percent and for 2 hours an overspeed trial of 20 percent above the normal revolutions was made, apparently with satisfactory results. A test was also carried out with boiler fuel oil, when the fuel consumption was found to be about 5 percent higher than when operating on Diesel oil.

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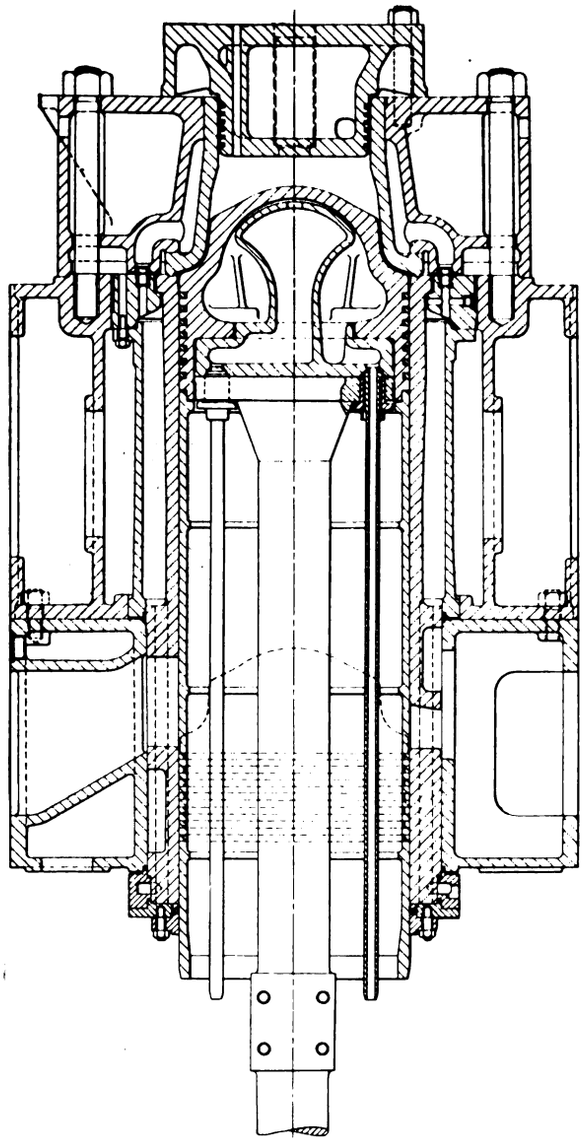
A 2,000 B. H. P. Two-Stroke Engine

Tests have just been completed on another interesting new Diesel engine which has been developed by Swan, Hunter & Wigham Richardsons, of Wallsend-on-Tyne. This firm originally acquired a license from the Atlas Diesel Company, of Stockholm, but they have now produced a motor differing very considerably from the early conceptions of the designers. The plant in question is a 2,000 brake horsepower six-cylinder set which will be installed in a cargo ship, and many more engines of the same size are in course of construction.



The Unusual Cylinder Design of the 2000 Brake Horsepower Neptune Diesel Engine

It runs at 100 revolutions per minute and has cylinders 22½ inches bore and 45 inches stroke. Unlike previous Diesel motors that have been constructed by the same firm, it has two piston scavenging pumps driven by beam levers off the engine crossheads at the back, while the piston and jacket cooling pumps, as well as the lubricating oil pumps, are operated by the same means, rendering the engine nearly self-contained.

An interesting point in this engine is that scavenging air is admitted through a single series of ports at the bottom of the cylinder as the builders do not apparently consider that a super-charging device is necessary as fitted in some other two-stroke motors. The piston head is shaped so that the scavenging air is deflected upwards towards the top of the cylinder, and discharges the exhaust gases through the ports on the opposite side which are likewise uncovered by the piston as it approaches the end of its stroke.

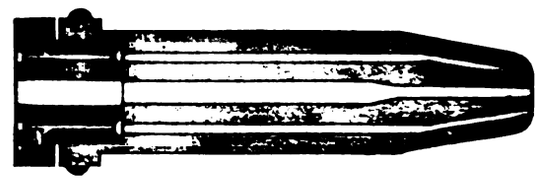
The problem of cylinder cover design is of the first importance in Diesel engines, and in this motor, as shown in the illustration, an arrangement is adopted quite unlike that in any other engine. The combustion chamber is the shape of a truncated cone, formed by a cylinder cover liner within the main cylinder cover. Above this however a small upper cover in which are located the fuel and starting air valves. In this way it is possible to cool the liner at the hottest point and it is claimed that the design will give complete immunity from cylinder cover troubles.

The reversing mechanism is not unlike that of the Sulzer engine. On the camshaft are side by side ahead and astern cams and each valve lever has two rollers on a forked end. Either of these is brought into contact with its cam, depending on the direction of rotation desired, this operation being effected by means of a large reversing wheel. Two hand levers control the starting process, each operating the necessary mechanism (through the intermediary of a servo motor) for three cylinders. Sea water is used for cooling the pistons and the jackets; for the former the water is supplied through a telescopic pipe, being discharged in the same manner. A special arrangement is devised by which the water is caused to pass at high velocity over the lower part of the piston crown, the piston being dome shaped.

Super-Mixing Tip for Metal Cutting Torches

THE Alexander Milburn Company, Baltimore, Md., has recently perfected a new type mixing tip for metal cutting torches.

The features of this tip are a method of super-mixing the gases and preheating the cutting oxygen as well as giving added velocity and penetration to the preheating and cut-



New Tip for Cutting Torches

ting jets. A further feature is that the tip is provided with a renewable seat at a fraction of the cost of a complete tip, rendering it unnecessary to re-machine or discard the entire tips. This renewable seat facilitates the cleaning and maintenance of the tip. In the standard tip the seat could be refaced by taking a thin cut off of it in a high speed lathe, but if the lathe is not available the seat cannot as readily be refaced.

The new tip retains all the advantages claimed for the tip which has been standard on Milburn torches for a number of years, with the added advantages noted above. The mixture of the preheating gases takes place in multiple passages in the renewable seat. These gases then pass into an annular passage where they are given a swirling motion and an additional mixing. The gases are again separated and expanded into enlarged multiple passages leading to the orifices in the tip proper. Here the preheating flames are projected with an increased velocity inclined toward the high pressure oxygen jet resulting in a speedier cut, a narrower kerf and a material saving in gases.

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Water Rates of Marine Reciprocating Engines*

Quick Method of Estimating Water Rates with a Reasonable Degree of Accuracy—Effect of Change of Clearances

By E. A. Stevens, Jr.†

HAVING been called upon to set standards for various ships of the Emergency Fleet Corporation, the writer was confronted with the fact that very little was known regarding the water rates of reciprocating engines. As this was one of the important items to determine before a reasonable fuel rate could be selected, it was decided, if possible, to devise a method whereby the steam consumption could be readily estimated with a fair degree of accuracy, for either an engine already in operation or one to be constructed.

Probably the best known and oldest method of approximating the water rates is by the use of indicator cards. Providing there are no undue leaks and the ratio of actual water rate to that calculated is known for a similar engine, working under approximately the same conditions as to pressure, expansions and superheat, if any, quite accurate results may be obtained but should the type of engine or the above conditions vary no reliable estimate can be made.

In the *Journal of the American Society of Naval Engineers*, Vol. XXIV, No. 1, February, 1912, there is an article by Mr. E. N. Jenson entitled "The Naval Reciprocating Steam Engine. Its Characteristics, Dimensions and Economics" in which is given the following formula:‡ Water rate $= \frac{(P_t \times 34) + 23}{M.R.P.}$ and in Vol. XXV, No. 2, of same journal there is one by Lieutenant Commander (now Captain) H. C. Dinger entitled "The Desirability of Using High Mean Referred Pressures" in which he published tables prepared by Mr. A. H. Raynal of the Bureau of Steam Engineering. If the water rate of an engine is known, that of another but having different initial pressure, expansions and mean referred pressure can be obtained by the use of either Jenson's formula or Raynal's tables.

The four main items that effect the water rate are initial pressure, expansions, mean referred pressure and clearances. The influence that a change of any of the first three items has on the economy of an engine can, as mentioned above, be calculated but no attempt has been made, that the writer knows of, to estimate what effect a change in the clearances would have. To those who have made a study of the reciprocating engine it has been known that decreasing the clearances reduces the water rate, but what this reduction is for a given reduction in clearances has never been determined. There is also considerable difference of opinion as to what cylinder, the clearance of which, has the most effect on the steam consumption. Some claim the high pressure cylinder is the only one whose clearances have any considerable influence, while others the low, while still others claim that an average of the three in a triple and of the four in a quadruple is the determining factor. The writer has found that the clearances of all cylinders have about equal influence if the clearance of the low pressure cylinder is added to the piston displacement of this cylinder when calculating the steam passing through the engine.

In offering this work to the engineering profession, it is hoped that it will be of assistance to those who have felt the need of a quick method of estimating water rates of reciprocating engines with a reasonable degree of accuracy as well as to be able to determine the effect of change of the clearances.

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†Department of Maintenance and Repair, United States Shipping Board, Emergency Fleet Corporation, New York, and member of Fuel Conservation Committee, U. S. Shipping Board.

‡ P_t = terminal pressure and M.R.P. = mean referred pressure.

Definitions and Nomenclature

As various terms are often used to convey different meanings, each term and its symbol is here given so that there will be no misunderstanding.

Cylinder or Piston Area, is the mean area, in square inches, of the top and bottom of the cylinder in question. The various ones are denoted as follows:

High pressure in all type	$= A_H$
Intermediate pressure in triples	$= A_M$
First intermediate pressure in quadruples	$= A_{M_1}$
Second intermediate pressure in quadruples	$= A_{M_2}$
Low pressure in all types	$= A_L$

Stroke is the distance in inches traveled by the piston from its top to bottom position and is denoted as L.

Piston Displacement is the volume swept by the piston in one stroke and is equal to the product of the mean area in square inches of the piston and the stroke in inches.

Clearances. In this work the clearances are expressed in either decimals or percentages of the piston displacement and are the means of the top and bottom. The volume includes that between the top of the piston and the cylinder cover when the piston is at the top of its stroke, or the bottom of the piston and the cylinder bottom when at the bottom of its stroke plus the volume of the respective passages from the valve to the cylinder. The mean of the volumes of the top and bottom in cubic inches divided by the piston displacement in cubic inches is the clearance expressed in decimals. This multiplied by 100 is equal to the percentage clearance.

Clearance of high pressure cylinder	$= Cl_H$
Clearance of intermediate pressure cylinder (triples)	$= Cl_M$
Clearance of first intermediate pressure cylinder (quadruples)	$= C_{M_1}$
Clearance of second intermediate pressure cylinder (quadruples)	$= C_{M_2}$
Clearance of low pressure cylinder	$= Cl_L$

Average Clearance. The average clearance is the sum of the clearances of all of the cylinders divided by three (3) in the case of a triple expansion engine and by four (4) for quadruples. Letting the average clearance $= Cl_A$. We have for triples

$$Cl_A = \frac{Cl_H + Cl_M + Cl_L}{3}$$

and for quadruples

$$Cl_A = \frac{Cl_H + Cl_{M_1} + Cl_{M_2} + Cl_L}{4}$$

Expansions. In this work wherever the term expansions is used it refers to the actual expansions, which is called R_a and is obtained as follows:

$$R_a = \frac{A_L \times (1 + Cl_L)}{A_H \times (CO_H + Cl_H)}$$

In which CO_H is the high pressure cut-off expressed in decimals of the stroke.

A_L = Area of the low pressure piston in square inches.
A_H = Area of the high pressure piston in square inches.
Cl_L = Clearance of low pressure cylinder in decimals of the piston displacement.
Cl_H = Clearance of high pressure cylinder in decimals of the piston displacement.

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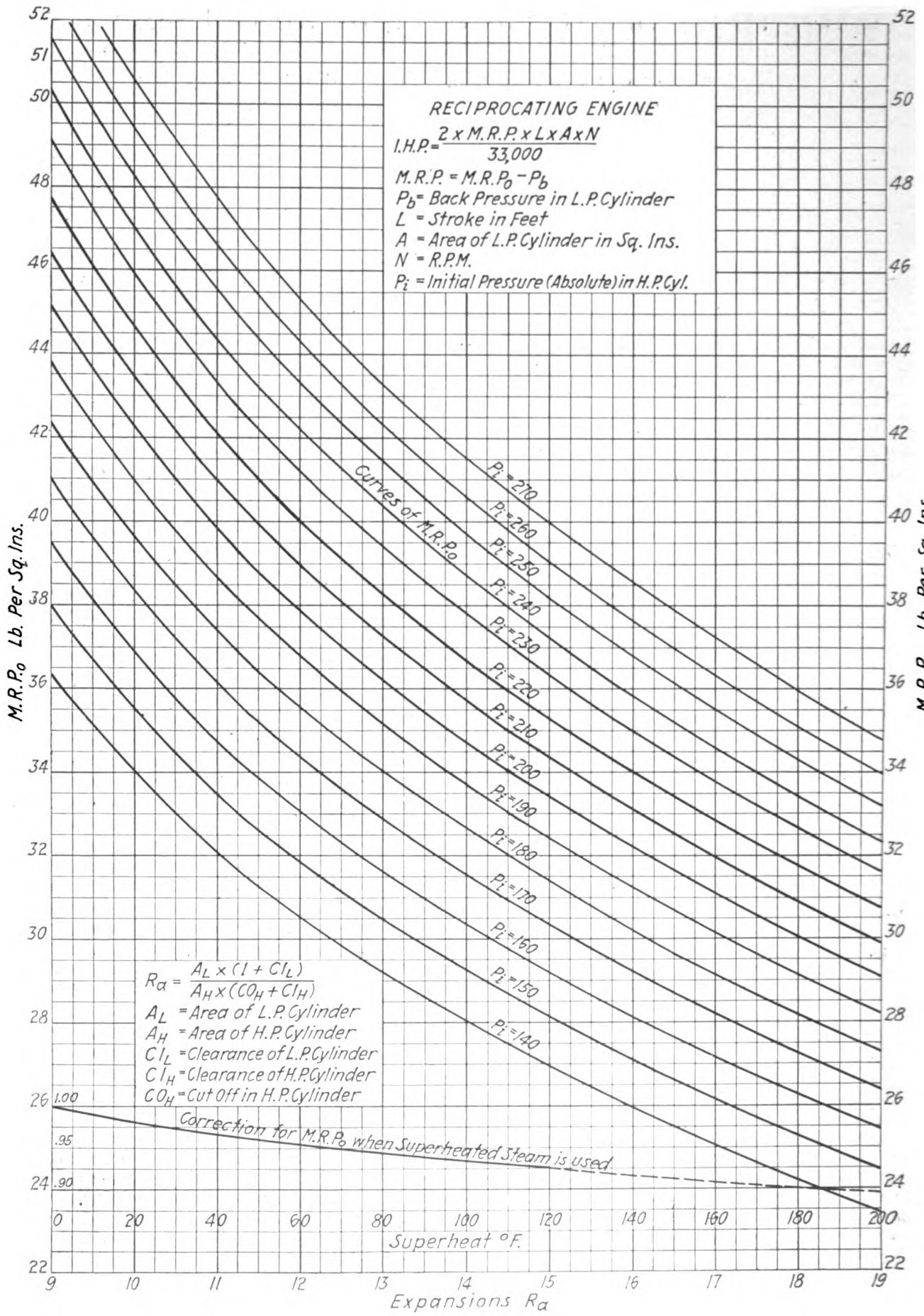
RECIPROCATING ENGINE
I.H.P. = 2 x M.R.P. x L x A x N / 33,000
M.R.P. = M.R.P$_o$ − P$_b$
P$_b$ = Back Pressure in L.P. Cylinder
L = Stroke in Feet
A = Area of L.P. Cylinder in Sq. Ins.
N = R.P.M.
P$_i$ = Initial Pressure (Absolute) in H.P. Cyl.
Curves of M.R.P$_o$
P$_i$ = 270
P$_i$ = 260
P$_i$ = 250
P$_i$ = 240
P$_i$ = 230
P$_i$ = 220
P$_i$ = 210
P$_i$ = 200
P$_i$ = 190
P$_i$ = 180
P$_i$ = 170
P$_i$ = 160
P$_i$ = 150
P$_i$ = 140
R$_a$ = A$_L$ x (1 + Cl$_L$) / A$_H$ x (CO$_H$ + Cl$_H$)
A$_L$ = Area of L.P. Cylinder
A$_H$ = Area of H.P. Cylinder
Cl$_L$ = Clearance of L.P. Cylinder
Cl$_H$ = Clearance of H.P. Cylinder
CO$_H$ = Cut Off in H.P. Cylinder
1.00
.95
.90
Correction for M.R.P$_o$ when Superheated Steam is used
0 20 40 60 80 100 120 140 160 180 200
Superheat °F.
M.R.P$_o$ Lb. Per Sq. Ins.
52 51 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22
9 10 11 12 13 14 15 16 17 18 19
Expansions R$_a$

Fig. 1

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Pressures. All pressures, unless otherwise stated, are given in pounds per square inch absolute, which equals the gage pressure plus 14.7 pounds.

Initial pressure or pressure in high pressure valve chest = P_i
Pressure at high pressure cut-off = P_{co}
Terminal pressure = P_t
Back Pressure in low pressure cylinder = P_b

The back pressure is as a rule from 1.75 to 2.5 pounds above the condenser pressure. The condenser pressure in pounds per square inch is approximately (30 inches—vacuum in inches) ÷ 2.

Mean Referred Pressure is the mean effective pressure necessary, if all of the power was developed in the low pressure cylinder. It is equal to the sum of the mean effective pressure of the low pressure cylinder and that of the other cylinders multiplied by their respective areas and divided by the area of the low pressure cylinder. Calling the mean referred pressure M.R.P., we have for triple expansion engines:

$$\text{M. R. P.} = \text{M. E. P}_{H.} \times \frac{A_H}{A_L} + \text{M. E. P}_{M.} \times \frac{A_M}{A_L} + \text{M. E. P}_{L.}$$

and for quadruple expansion engines:

$$\text{M.R.P.} = \text{M.E.P}_{H.} \times \frac{A_H}{A_L} + \text{M.E.P}_{M_1.} \times \frac{A_{M_1}}{A_L} + \text{M.E.P}_{M_2.} \times \frac{A_{M_2}}{A_L} + \text{M.E.P}_{L.}$$

in which

A_H, A_M, etc., are as given before, while the mean effective pressures are denoted as follows:

M. E. $P_{H.}$ = High pressure cylinder, all types.
M. E. $P_{M.}$ = Intermediate pressure cylinder, triples.
M. E. $P_{M_1.}$ = First intermediate pressure cylinder, quadruples.
M. E. $P_{M_2.}$ = Second intermediate pressure cylinder, quadruples.
M. E. $P_{L.}$ = Low pressure cylinder, all types.

Water Rate. The amount of steam used during a period of one hour divided by the average indicated horsepower developed during the hour is called the water rate. As the power developed by the auxiliaries is seldom determined, it is more convenient to base all water rates on the indicated horsepower of the main engines.

The water rate of the main engine is the steam used by it per indicated horsepower while that used for purposes other than the main engine, divided by the indicated horsepower of the main engine, is called the water rate of the auxiliaries.

The total water rate is the sum of that of the main engine and the auxiliaries.

Relation of Mean Referred Pressure to Initial Pressure and Expansions

As the relation of the mean referred pressure to the initial pressure and expansions has a decided bearing on the performance of engines, it might be well briefly to review this subject before taking up the question of water rates.

The usual method of estimating the mean referred pressure by the use of the card factor is too well known to be discussed here, except to say that if the card factor is known of an engine working under about the same initial pressure, expansions and superheat, if any, quite accurate results may be obtained. Professor Edward M. Bragg, of the University of Michigan, in his book, "The design of Marine Engines and Auxiliaries," points out the various difficulties of this method and offers as a substitute the following formula:

$$\text{M. R. P}_{o.} = H \times P_i \times \left(\frac{R_a}{P_i}\right)^{.4}$$

in which
M. R. $P_{o.}$ = M. R. P. + P_b
M. R. P. = Mean referred pressure
P_b = Back pressure in low pressure cylinder
P_i = Initial pressure absolute
R_a = Actual expansions
H = Constant depending on R_a

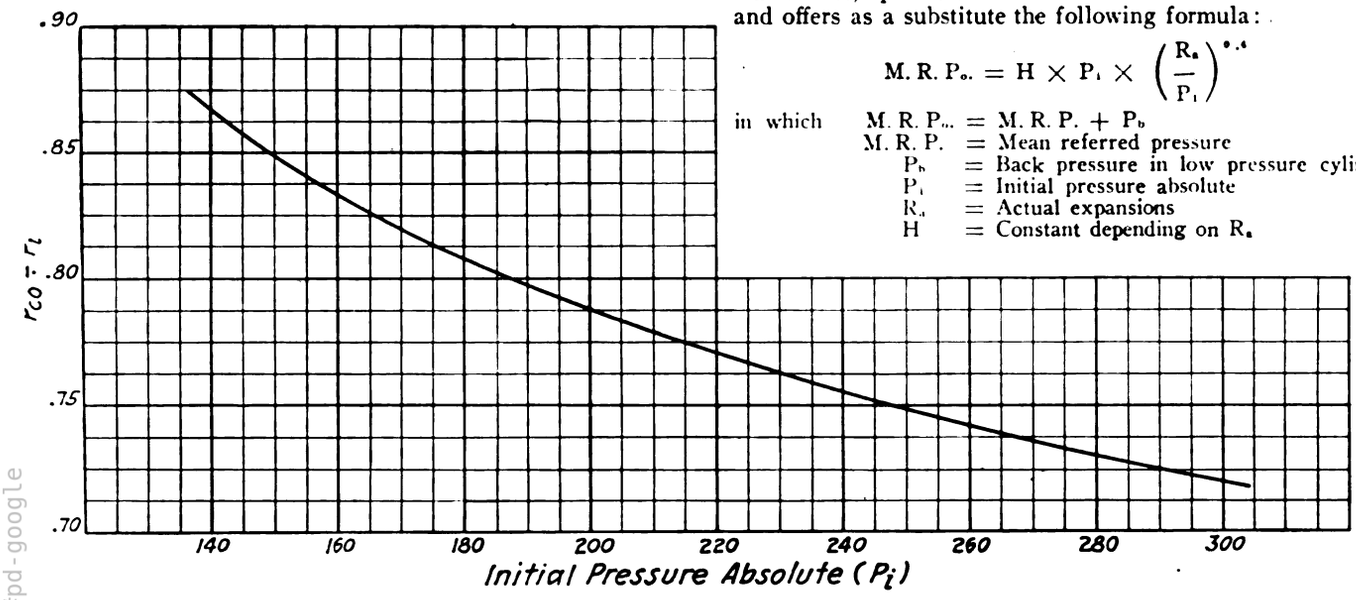

Fig. 2

This formula has been checked by the writer on about forty engines and has been found to be very accurate.

In order to save the time that it takes to figure the M.R.P_o. in each case, calculations were made for pressures varying from 140 to 270 pounds absolute and expansions from 9 to 19 and curves drawn as shown in Fig. 1.

On the lower part of this chart is shown the effect that superheat has on M.R.P_o. This was also taken from the work of Professor Bragg up to superheats of 120 degrees F. Beyond that point the curve, which is shown in dotted lines, is only approximate.

Example No. 1

Given initial pressure = P_i = 195 pounds absolute
Actual expansion = R_a = 10.25
Back Pressure = P_b = 4½ pounds absolute
Find mean referred pressure when using saturated steam and with 75 degrees F. superheat.

From Fig. 1 we find for R_a = 10.25 and P_i = 195 pounds.

M. R. $P_{o.}$ = 41.05 pounds

then M. R. P. = M. R. $P_{o.}$ — P_b = 41.05 — 4.5 = 36.55. If 75 degrees F. superheat is used, the value of M. R. $P_{o.}$ will be 94.6 percent of that with saturated steam; then with 75 degrees F. superheat:

M. R. $P_{o.}$ = 41.05 × 0.946 = 38.85 and
M. R. P. = M. R. $P_{o.}$ — P_b = 38.85 — 4.5 = 34.35

Example No. 2

Given initial pressure = P_i = 220 pounds absolute
Back pressure = P_b = 5 pounds absolute
Mean referred pressure = M. R. P. = 34.5 pounds

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Find expansions R_a when saturated steam is used and with 120 degrees F. superheat

M. R. P_o. = M. R. P. + P_b = 34.5 + 5 = 39.5 pounds.

From Fig. 1 we find that curve of P_1 = 220 is cut by the horizontal line representing M. R. P_o. = 39.5 at R_a = 12.3. This will be the expansions required to obtain the given M. R. P. with the given initial pressure (P_1) when using saturated steam.

When using 120 degrees F. superheat we find that M. R. P_o is 92.5 percent of that when saturated steam is used; therefore, the corrected M. R. P_o. for entering Fig. 1 will be 39.5 ÷ 0.925 = 42.7, which corresponds to an expansion (R_a) of 10.77.

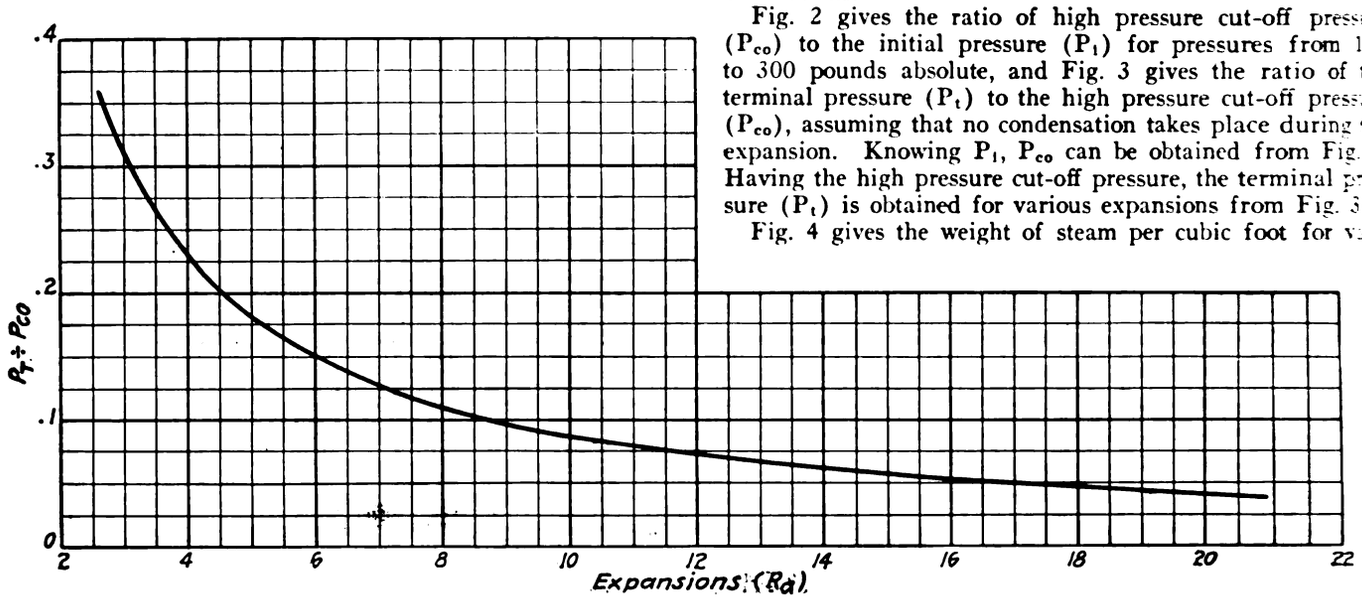

Fig. 3

Water Rates of Main Engines

The method used to estimate the water rate is to obtain the weight of steam in the low pressure cylinder when the piston is at the end of its stroke, assuming the pressure at this point to be equal to the terminal pressure (P_t). The product of this and the number of strokes made during an hour and a correction factor gives the weight of steam passing through the engine during this period. This divided by the indicated horsepower (I.H.P.) gives the water rate.

Although the speed of the live and exhaust steam through the valve ports, the piston speed and condensation affect the water rate, the correction factor mentioned above depends almost entirely on the clearances. If the steam speed through the valve ports is excessive, the drop between the cylinders will be large, thereby reducing the mean referred pressure and indicated horsepower which is taken care of, at least to a great extent, in the calculations. If the piston speed is over 500 feet per minute, its influence on the water rate is very small and may be neglected. Excessive condensation, which can be prevented by proper insulation, lowers the mean referred pressure and is therefore accounted for in the calculations.

Fig. 2 gives the ratio of high pressure cut-off pressure (P_{co}) to the initial pressure (P_1) for pressures from 14 to 300 pounds absolute, and Fig. 3 gives the ratio of the terminal pressure (P_t) to the high pressure cut-off pressure (P_{co}), assuming that no condensation takes place during the expansion. Knowing P_1, P_{co} can be obtained from Fig. 2. Having the high pressure cut-off pressure, the terminal pressure (P_t) is obtained for various expansions from Fig. 3.

Fig. 4 gives the weight of steam per cubic foot for various pressures from 8 to 30 pounds absolute as given in Marks and Davis "Steam Tables."

Letting Δ = Weight of steam per cubic foot at the terminal pressure.
R. P. M. = Revolutions per minute.
A_L = Area in square inches of low pressure cylinder.
L = Stroke in inches.
C_L = Clearance of the low pressure cylinder in decimals.
M. R. P. = Mean referred pressure.

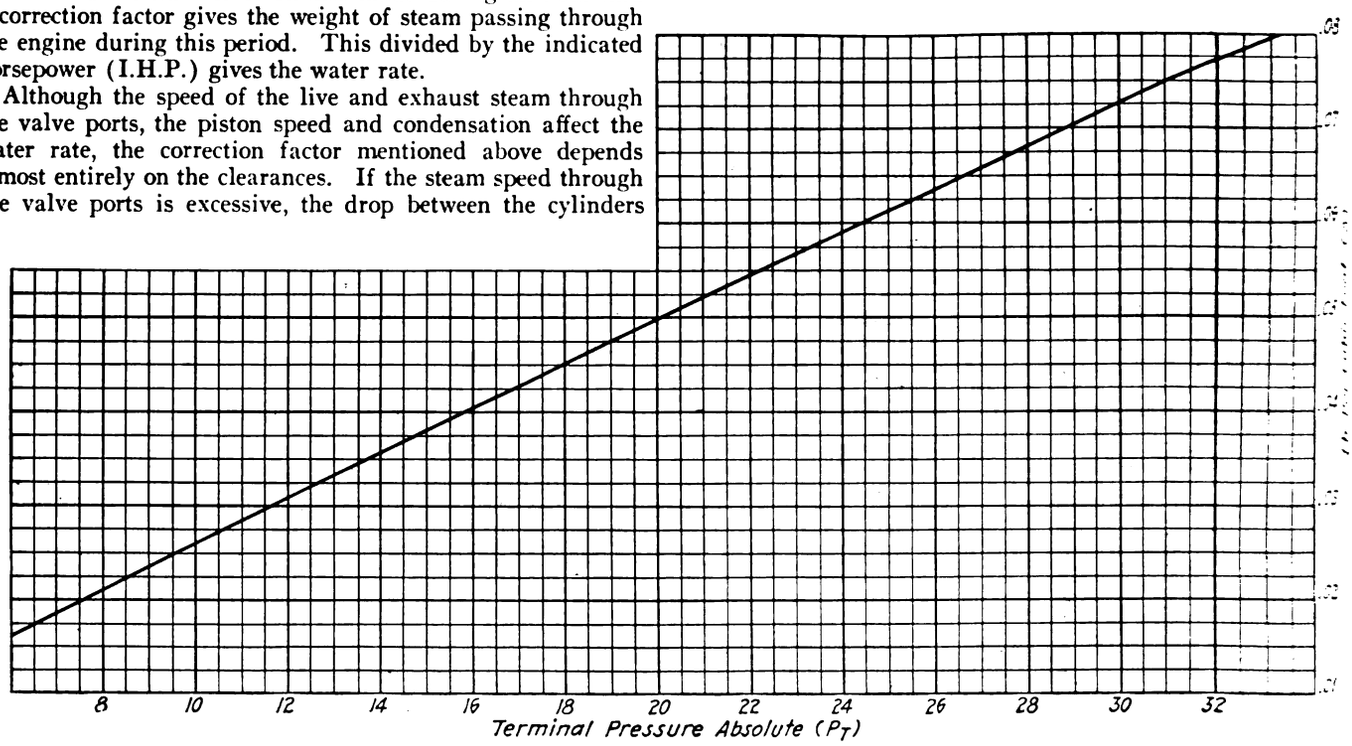

Fig. 4

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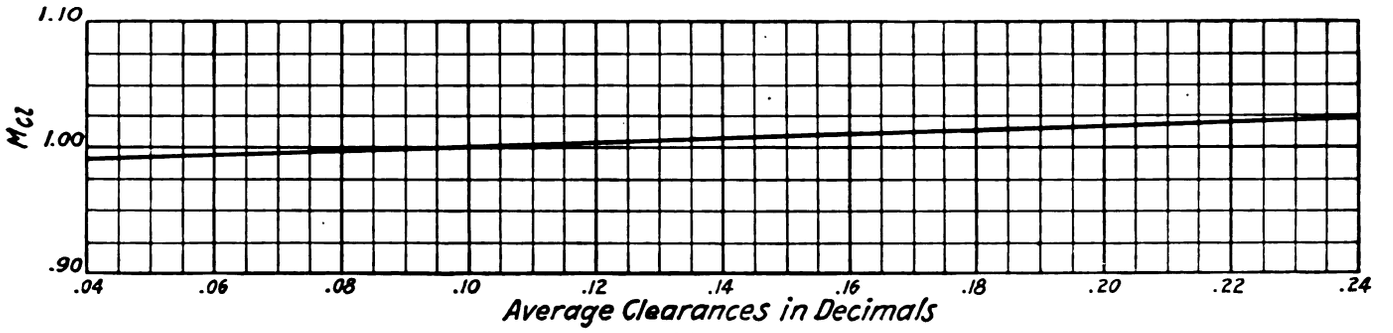

Fig. 5

Steam passing through engine in one hour, neglecting the correction factor for clearance $:= \frac{2 \times A_L \times L \times R.P.M. \times \Delta \times 60 \times (1+Cl_L)}{1728}$

$= \frac{A_L \times L \times R.P.M. \times \Delta \times (1+Cl_L)}{14.4}$ and indicated horsepower

$= \frac{2 \times M.R.P. \times A_L \times L \times R.P.M.}{12 \times 33000}$

$= \frac{M.R.P. \times A_L \times L \times R.P.M.}{198{,}000}$. Then water rate (neglecting correction factor for clearance) $= \frac{\text{Water per hour}}{I.H.P.}$

$= \frac{A_L \times L \times R.P.M. \times \Delta \times (1+Cl_L) \times 198{,}000}{14.4 \times M.R.P. \times A_L \times L \times R.P.M.}$

$= \frac{13750 \times \Delta \times (1+Cl_L)}{M.R.P.}$.

Fig. 5 gives the correction factors for various average clearances. Calling this factor M_{cl} and multiplying the above formula by it, the water rate of the main engine at full load is

$$W.R. = \frac{13750 \times \Delta \times (1+Cl_L) \times M_{cl}}{M.R.P.}$$

If the engine is carefully designed with short straight passages from the valve chest to the cylinder, where piston valves are fitted, and if the live and exhaust steam speeds through the valve ports and passages are not excessive, and where the workmanship is first-class, the values of M_{cl} will usually be about two percent less than those shown, but it would not be advisable to use these lower figures when calculating the water rate of a new engine for fear of underestimating.

EXAMPLE NO. 3

Given a triple expansion engine using saturated steam initial pressure $P_i = 200$; expansion $R_e = 11$; high pressure clearance $= Cl_H = .10$; intermediate pressure clearance $= Cl_M = 0.07$; low pressure clearance, $Cl_L = 0.065$; average clearance $= 0.078$; mean referred pressure $=$ M. R. P. $= 35$ pounds.

To find the water rate:

From Fig. 2 we find $P_{eo} \div P_i = 0.788$ then $P_{eo} = 200 \times 0.788 = 157.6$ and from Fig. 3, $P_t \div P_{eo} = 0.079$, then $P_t = 157.6 \times 0.079 = 12.43$.

From Fig. 4, we find the weight of steam per cubic feet at 12.43 pounds absolute is 0.032 pound and from Fig. 5 we find that $M_{cl} = 0.996$.

Then the water rate will be $W.R. = \frac{13750 \times \Delta \times (1+Cl_L) \times M_{cl}}{M.R.P.}$

$= \frac{13750 \times .032 \times 1.065 \times .996}{35} = 13.32.$

CORRECTION FOR STEAM JACKETS

It is very difficult to determine just what effect the use of steam jackets has on the water rate as there are so many conflicting reports; some claim a saving and others a loss. It would seem that if the steam used in the jackets were charged against the engine, as it should be, the water rate would be greater when the jackets were in use. The trials of the H.M.S. *Argonaut* published in the *Transactions of the Institution of Naval Architects*, Volume 14, showed that when the jackets were used the water rate was higher than when they were not in use. The percentage increase being greater at the higher loads, this increase is shown in Fig. 6 with M.R.P. as abscissas. The cylinder barrels only were jacketed; if the ends were also jacketed, the increase in the water rate would probably be about 50 percent greater.

During these trials it was discovered that jacketing the high pressure cylinder changes the water rate very slightly, in fact hardly any, while jacketing the intermediate and the low had practically the same effect as jacketing all cylinders.

There are not sufficient data at hand to state just what effect the use of steam jackets would have on an engine using steam superheated to about 50 degrees F. or over, but it would seem from what information there is, that the increase in water rate when jackets are used would be about half that of an engine using saturated steam.

As there are very few engines in the merchant service using steam jackets, this item is not very important, but if they are used, the correction should be made. The engine in Example No. 3 had at full load a M.R.P. $= 35$ and a water rate of 13.32. From Fig. 6, the correction factor or multiplier (M_j) for jackets (for a M.R.P. of 35) is 1.022. Then the water rate when steam jackets are in use $= 13.32 \times 1.022 = 13.63$.

(To be concluded)

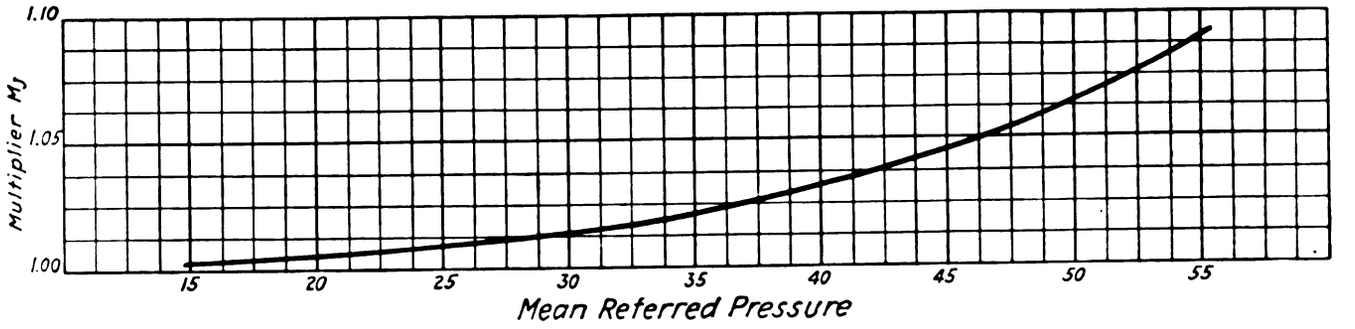

Fig. 6

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Lubricating Diesel Engines and Auxiliary Machinery

General Rules for Selecting Lubricants and Methods of Applying Them to Promote Economy

CIRCULATING force-feed lubrication to all Diesel engine crank shaft bearings is now recognized as superior to other methods of lubrication. There are some operators, however, who still object to the inclosed crank case construction always used with this lubricating system, because they are unable to test the bearings by hand to determine if they are running hot. There is, however, slight danger of overheating because most of the bearing troubles formerly experienced have been where wick or other form of drop lubrication was used. This form of bearing trouble is practically unknown with the pressure system, if the clearances are correct and the oil flow uninterrupted.

In some engines oil is led to the crank pin under pressure by means of passages drilled through the crank shaft from the main bearings to the crank pins. This construction is sometimes combined with similar passages drilled in the connecting rods to convey oil from the crank pins to the wrist pins. The general custom is, however, to lubricate the crank pin by collecting the oil leaking from the main bearings into rings attached to the crank cheek. There is usually sufficient centrifugal force to cause a positive flow of oil by this means to the crank pin.

One advantage of the tightly inclosed crank case is to prevent all oil waste which would otherwise occur, due to the excess oil in the pressure system being thrown from the rotating parts. Dust and dirt are also kept from entering the lubricating system where it would form an abrasive and cause rapid bearing wear. Filters are always used between the oil pump and bearings, preferably of the duplex type. This system allows one to be cleaned at a time without interfering with the flow of oil. Screens should also be used between the crank sump and the oil pump to strain out any foreign matter, such as rags and the like, which would interfere with pump action. Cotton waste should never be used about any engine with a circulating lubricating system. This is an unfortunate practice but one that is common.

A tank should be placed in the system to allow very fine foreign matter to settle out of the oil which would otherwise pass through the filters. This tank is sometimes combined with the filter or used as a reserve oil tank. Drains are fitted under this tank to draw off sediment and any water that might have separated from the oil. Water, especially salt water, must be prevented from mixing in the lubricating oil.

Oiling the Cylinders

The oil sprayed from the crank and crank shaft bearings is sufficient to reach the cylinders to a considerable extent in trunk piston engines and, in some cases, it has been found ample for the lubrication of the cylinders. In fact too much oil generally finds its way into the cylinders in this system. Cases are on record where the excess of lubricating oil entering a heated engine has been sufficient to run that engine with the supply of fuel oil cut off. This is an extreme case but is apt to occur to a slight extent, if precautions are not taken to prevent the waste and, incidentally, boost the operating cost considerably since excess lubricating oil is an expensive fuel. Splash guards can be installed to advantage to deflect oil sprayed from the cylinders. Certain designers utilize the crosshead piston type to make correct cylinder lubrication possible. In these designs it is usual to lubricate the cylinders with specific quantities of new oil supplied by mechanical force feed lubricators to deliver oil to two or more points equidistant around the cylinder at a height just below the top piston ring when the piston is at the bottom of its stroke. The plungers of the lubricator should be timed to deliver the oil at the end of the power stroke, in an amount just sufficient to provide lubrication. In the usual type of engine, partly burned oil and fuel work past the piston and contaminate the crank case oil not only with carbon particles, but also with fine particles of iron worn from the cylinders, and ash from the fuel. Water contamination also sometimes occurs. There are usually two distinct lubricating systems in Diesel engines —one for the bearings where the oil is used over and over again and where a cooler is sometimes needed to prevent the oil from getting too hot and the other system for the cylinders where the oil is used only once. There are a number of places about the valve gear which must be oiled by hand and grease cups which must be filled. Valve stems are often left with no other provision for lubrication than hand oiling, in some cases it being necessary to squirt a mixture of oil and kerosene on the valve stems to thin down any oil which has thickened from exposure to the heat of the exhaust, especially when an unsuitable lubricating oil has been employed.

Requirements of Lubricating Oils for Diesel Engines

Many operators of Diesel engined ships understand the necessity of using an oil that is well refined and of high quality for the lubrication of their engines. There are many aspects of the problem of oil selection that render it complex and make the requirements more rigid than for other classes of machinery.

The lubrication requirements of power cylinders, air cylinders and bearings vary widely, and when the engine is so constructed as to permit of the use of separate oils for these parts, each set of requirements may be met by a lubricant possessing exactly the requisite qualities.

Many marine Diesel engines are so built and equipped that a single oil must be used for all parts and must therefore meet all of these diverse requirements—a condition that still further limits the operator in his choice of an oil, as there are very few oils that are capable of successful use for such varied purposes.

Power Cylinders

Power cylinders demand an oil which, at the high temperature of the cylinder walls, will possess sufficient body to form and maintain an effective lubricating and sealing oil film, and still it must not be so heavy that it will not distribute and spread rapidly.

Although any oil will vaporize to some extent in the engine cylinder, it must not vaporize so freely as to fail in its function as a lubricating and sealing medium. Vaporization of an oil results in leaving behind a residue, which is first soft becoming more gummy and sometimes reducing to a hard carbon deposit. These deposits cause serious trouble with piston rings and valves. The character of the oil should minimize the formation of such deposits, and what deposit is formed should be easily removed.

The oil should be chemically stable, so that it will not be affected by sulphur and other elements in the fuel to the extent of thickening or losing its lubricating value.

It is highly advantageous to use an oil so rich in lubri-

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cating value that very small feed will suffice for piston lubrication and seal. Where the method of cylinder lubrication permits the quantity of oil to be limited to the exact amount needed, such a practice greatly decreases and frequently eliminates the formation of cylinder deposits.

Air Compressors

Air cylinder lubrication presents another set of requirements. The oil is subjected to less extreme temperature conditions than in power cylinders, and therefore need not be of quite as heavy body to lubricate and seal the pistons.

Air compressor cylinders are subject to moisture, which interferes with the adhesion of an ordinary mineral oil. While this condition is improved by the use of selected mineral oils, strong adhesion of the oil to cylinder walls in the presence of moisture is accomplished only by an oil that is carefully manufactured and correctly compounded.

Carbon formation in air compressors is not only injurious to the operation of piston rings and valves, but is dangerous, as a contributory cause toward explosions. The secret of the avoidance of carbon and gummy deposits lies first in the use of an extremely small oil feed, which is still sufficient for lubrication and piston seal provided the oil possesses extremely high lubricating characteristics; and, second, in other characteristics of the oil which tend toward the formation of soft deposits, rather than hard carbon.

Diesel Engine Bearings

The fact that bearing oil for Diesel engines is kept in rapid circulation imposes upon it a new requirement. It must be a durable oil, which will separate readily from impurities, such as metal particles, grit and water, and will not form emulsions when agitated in a slightly impure condition. Such an oil requires exceedingly thorough treatment by the manufacturer, and the crudes must be specially selected.

A very heavy body is not favorable to the above conditions, and too heavy an oil would cause unnecessary fluid friction in the bearings. The oil for this purpose is, therefore, lighter in body than that selected for power or for air cylinders.

Diesel Engines Using a Single Oil

The foregoing statements make clear the earlier statement that there are few oils that are able to lubricate all parts of the Diesel engines. The power cylinders demand an oil that is heavy—the bearings a lighter oil. Compounding the power cylinder oil would not ordinarily improve it, and a compounded bearing oil would emulsify and clog the circulation system, and still compounding is desirable for the air compressor oil.

These conflicting requirements call for a compromise, which is fortunately possible in a very small number of high grade mineral lubricants that have been manufactured from carefully selected crudes by special processes. An oil to meet this condition must not be a by-product from the refining of burning oils. No better guide can be found than the lubricating oil manufacturer who has specialized in the art of making lubricants to meet specific conditions. If such a manufacturer has worked with the engine builder in solving his special problem and has followed the lubricants in the field, to observe their operation and correct difficulties, his authority can be regarded as final.

Lubrication a Secret of Successful Compressor Operation

The problem of adequately lubricating the compressors in connection with the Diesel installation is a serious one since a minimum amount of oil must be used for the sake of safety. Any excess oil will carbonize because of the temperature to which it is exposed. This carbon is sticky in the early stages of its formation which gives it a tendency to adhere to the piston rings, valves, receivers and may be carried even to the fuel valve parts. Later in its formation the carbon forms a hard solid that interferes materially with the compressor operation. All oils will deposit more or less carbon but some of them a great deal less than others. For this reason the oil should be selected with care and, as stated above, a minimum amount used. The stages of most air compressors are arranged with the intermediate stage at the bottom so that there is always a pressure opposing the tendency of oil to work up into the air space from the lowest cylinder wall where it is thrown by the crank pin.

The low pressure or first stage cylinder is supplied with oil by means of a mechanical lubricator which feeds small measured quantities of new oil to these parts. A second oil fuel is sometimes provided for the second stage cylinder. A drop or two a minute to the first one or two stages is sufficient. The third stage is amply supplied by oil carried up from the second. To insure proper regulation, the valves should be removed from time to time and the cylinder walls examined. They should feel oily, but no more than this.

It is very desirable to clean out the air compressor system frequently and wash out the carbon deposits before they grow to large proportions. Kerosene or any similar light oil must under no circumstances be used for this purpose because of the danger of explosive mixtures. Soapsuds are used for cleaning, made up from a solution of soft soap and water which is fed into the air intake or through the lubricator about ten times as fast as the usual oil supply. The quantity used must be judged by the amount of carbon found on the valves when they are inspected. After an application of this kind, the receivers must be blown down to remove all the soapy water and oil should be applied again for a time before shutting down in order to prevent rusting.

Auxiliary Machinery Lubrication

More waste is caused by the faulty lubrication (both method and quality) of auxiliary machinery than is the case with main engines.

Roughly classified, auxiliaries fall in two divisions; engine and boiler room auxiliaries and deck auxiliaries. The former includes electric lighting sets, forced draft apparatus, ventilation fans, refrigeration machinery, pumps, etc., under the head of deck auxiliaries are included electric motors, steering engines and attachments, windlasses, winches, hoisting engines, etc. The majority of the auxiliaries are operated by steam cylinders, both vertical and horizontal engines being used, though small steam turbines and electric motors are becoming common.

Usually the trouble with steam cylinder valves and stuffing boxes becomes apparent in the dry rubbing surfaces of piston rods, valve stems, cylinder walls, valve faces and seats. It is also apparent in the sluggish starting action when the throttle is opened, and in poor valve action. It also becomes difficult to maintain stuffing boxes on the piston rod and valve stem tight. Parts wear rapidly and piston rods and valve stems have a tendency to score badly.

Lack of Lubrication a Cause for Difficulty

Too little oil, improper application of oil and the use of an incorrect oil are mainly responsible for dry rubbing surfaces. The trouble is readily corrected by making mechanical fits as nearly right as possible for valves and seats, cylinder walls, and piston rings, rods and glands. Cylinder oil should be applied at a slow uniform rate by some automatic device which feeds lubricant into the center of the steam pipe above the throttle, preferably through an atomizer. It is absolutely essential that the correct cylinder oil be used which will atomize in the steam pipe and form an adhesive lubricating film on wet rubbing surfaces, and maintain an oil seal between the parts to resist leakage of steam.

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Oftentimes marine lighting sets, centrifugal circulating pumps, forced draft and ventilating fans, and refrigerating machines are driven by high speed vertical engines. It is not uncommon in operation for oil pipes to become bent or broken, and for oil passages to clog. These mechanical troubles, however, can be corrected readily.

Lubrication troubles manifest themselves in the formation of emulsion and sludge in the crank case of a splash oiled engine, or in parts of an oil circulating system. Bearings, crank pins, cross heads, guides and eccentrics show rapid wear accompanied by undue noise in operation. Bearings become hot in the generator, centrifugal pump, fan or refrigerating machines.

The causes for these troubles are easily determined. Water of condensation leaking from the stuffing boxes into the oil quickly emulsifies in the crank case of a circulating system due to the agitation of the mixture. This emulsification and sludge reduce the lubricating power of the oil, reduce the flow of oil and cause heating and wear. Where ring oilers are used, if any of the rings fail to revolve around the shaft, hot bearings result. If drop feed oil cups are installed, hot bearings will result from cessation of feed, or from slowing down of the feed due to the clogging of the small needle valve in the bottom of the cup.

A light bodied mineral oil of high lubricating quality that quickly separates from water and impurities is most suitable for the lubrication of lighting sets and their high speed machines of similar type. By its use emulsification of oil in the crank case can be eliminated. To aid in accomplishing this result, however, water should be drained off frequently. A small quantity of oil should be drawn from the system daily and replaced by pure oil. The oil drained off can be filtered and then returned to the system, making it possible to use this supply almost indefinitely, with additions to replace leakage. If sludge collects, the crank case should be drained, cleaned out and refilled with new oil or with oil that has been filtered.

In case of ring oiled bearings where the rings have been bent or worn they should be replaced.

Wick feed oil cups operate with greater certainty than drop feed oil cups, and may well be used to replace the latter. Both types of cups, however, require care and attention in order to insure reliability of service.

Lubricating Steam Pumps Externally

In the lubrication of boiler feed pumps, air pumps, water, oil, fire and bilge pumps operated by steam cylinders, difficulties manifest themselves in rapid wear, irregular and uneven running and loss of power. If the troubles are mechanical, loose parts should be adjusted and repaired or replaced by new ones. Where possible hand oiling should be replaced by the use of automatic oiling devices such as wick feed oil cups, bottle oiler or drop feed cups. With high speed machinery the oiling must be regular and continuous.

In the case of centrifugal pumps, hand or wick feed oiling is customary on the driving unit, using the same oil as on the main engine. When a forced feed lubrication system is used on the main engine, however, this same service is supplied to the pumps. Wick feed is more positive than hand oiling, and is to be preferred for the constant and uniform oil service necessary for the high speeds of centrifugal pumps.

The water cylinders of pumps are lubricated only by the water present. Outside packed plungers are lubricated by a special grease or a heavy oil to preserve the packings.

Steam Turbine Driven Auxiliaries

Small turbines, either direct connected or fitted with reduction gears are in many cases used for driving electric lighting sets. Turbo pumps and blowers and other high speed marine machinery lubrication troubles generally show themselves in abnormally hot bearings. If the bearings are ring oiled the rings may have failed to revolve properly with the journal. Heating may also result in the partial stopping of circulation due to the collection of sediment at the suction strainer of the circulating pump. If the oil forms an emulsion with the accumulation of water in the system, lubrication is faulty.

Trouble is also caused by the use of an unsuitable oil. Too light an oil will result in the failure of the oil film thus permitting contact between the metal surfaces causing rapid heating and possible loss of the bearings.

Preventing Trouble with Turbine Driven Auxiliaries

In the case of ring oiled bearings the ring should be maintained true to form, an oil used that is not too heavy, and the oil well not filled to overflowing. Bearings should be protected from water and steam leakage and the oil in the circulating system purified frequently and kept free from sediment.

Blower and fan lubrication is relatively simple. The shaft bearings are generally ring or chain oiled and only require periodic filling with a straight mineral oil of low viscosity.

Internal Lubrication of Deck Machinery

Because of the fact that anchor windlasses, cargo winches, capstans, towing machines and steering engines have long periods of rest during which they are exposed to weather and sea action, troubles encountered with them are much more varied than in the case of the auxiliaries below deck.

Steam cylinder valves and stuffing boxes require the same attention as the engines below decks, and in addition the deterioration from rusting and pitting action on the piston, cylinder walls, valves and the like must be provided against.

Cold weather brings its toll of cracked cylinder and valve chests and causes piston rings to stick. Excessive steam leakage and sluggish starting, dry and hard packings also show up when the engine is started.

In general these troubles are due to water remaining in the cylinders and valve chests and to the sea water falling on exposed parts causing rusting and pitting. During periods of rest inferior oil becomes gummed to such an extent as to prevent the action of the piston rings. Packings become dry and lose their resiliency through pressure and lack of the protective oil coating.

When a deck machine is shut down for a voyage, cylinders should be drained of all water to prevent freezing and cracking, and to reduce corrosion and pitting. If a little extra oil is fed into the cylinders just before shutting down, provided the correct quality of oil is used, the internal parts will be effectively protected from corrosion, and the piston rings prevented from sticking when again started.

Cylinder oil should be swabbed on the rods after shutting down and the glands of the rod packings loosened slightly at this time and tightened when the machine is put into service in order to avoid hardening.

The external parts of deck machinery oftentimes show rapid wear of the journals and bearings, guides and shippers. Gears also show rapid wear and become noisy. This wear is generally due to lack of correct lubrication. Noise and lost motion, when they are apparent, develop serious troubles, if mechanical adjustments are not attended to.

Oiling which is usually done by hand is frequently neglected. Lubrication either automatic or hand should be made with a heavy compounded oil which will stay in place and prolong the lubricating effect. Wherever possible automatic devices should be installed for open gears. A special adhesive gear lubricant should be applied hot to the gear teeth. This lubricant should be heavy enough to deaden the sharp blow of the gear teeth on one another, and to follow up the gear teeth in such a way as to keep the contact surfaces thoroughly coated and protected from corrosion

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The Natural Periods of Vibration of Ships

A Short Cut Method for Determining the Frequency Period of Vertical Vibration Due to Bending Only

By E. H. Rigg*

THE problem of vibration is always present as a possible stumbling block in the way of a successful design. As regards the engines themselves the question has been tackled vigorously in the past both as regards reciprocating engines and latterly as regards geared turbines. The rapid growth in number of Diesel engined vessels renews our interest in the problem; we are asked to put Diesel engines into vessels of all sorts and with the departure from the customary ranges of revolutions per minute for reciprocating steam engines there is danger of some bad vibration cases. To avoid revolutions per minute in the regions of the ship's natural periods becomes imperative in cargo ships and much more so in passenger ships.

In working out a recent case the writer had occasion to look up available information, finding a paper by Mr. T. C. Tobin before the Institution of Naval Architects (London) in 1922 decidedly informative. He also found a good paper by Dr. L. Gümbel before the same society in 1912 and another by Mr. W. Gatewood in 1915 before the Society of Naval Architects and Marine Engineers (New York); both of these latter papers leave us facing the "A" coefficient mentioned at the beginning of Tobin's paper.

A Short Cut to Tobin's "p" Factor

The method given by Mr. Tobin is somewhat involved, but not unduly so for an important ship which is really being built; it is, however, too lengthy for use in design work, and when revolutions per minute have to be at least preliminarily settled long before the full calculations involved could be made. The writer began to cast around for a short cut to Tobin's "p" factor and has found one which has stood the test of experience in comparison with at least three cases with which he is acquainted. There are only two factors in the formula

$$P = \frac{n^2}{2\pi}\sqrt{\frac{EIg}{\Delta L^3}}$$

which give trouble, namely E and I, modulus of elasticity and moment of inertia.

The first runs from 10,000 to 12,500 inch ton units (see discussion on Tobin's paper). A mean value of 11,000 has been arbitrarily used and appears to check up properly. The proper value for "E" for a ship structure is determinable only by experiment and observation aboard ship in a seaway. Compromise is a good old fashioned rule which shipbuilders have perforce used in the past, but which is being fast replaced by more scientific methods. It is only the necessity of using some figure for "E" which suggests arbitrary compromise in this case.

Some more explanation of Tobin's "p" factor is in order, this is the key to the whole difficulty and arises because the mass and rigidity vary along the length of the ship and in fact are not the same on any two voyages, though practically so in liners and perhaps in tankers and other special vessels; hence, also the desirability of giving the critical revolutions per minute a decently wide berth to allow both for difficulties of exact calculation and for variations in loading. The value, or lack of value, of this article depends on the closeness of the agreement between the proposed approximate methods and Tobin's detailed methods, very much as the proximate analysis of coal samples may serve most practical purposes as compared with the full analysis.

The proper value of "I" is another factor. To calculate the curve of "I" for each section of the vessel and plot the curve all fore and aft is not a design-stage proposition; in fact it is only for special jobs that such a curve would be run. Analyzing a few such curves, the writer found a mean value for "I" expressed as a percentage of the "I" amidships. This mean "I" came out at 60 percent of the midship value for ships with a block coefficient of 0.45 and ran up to 84 per cent for a block of 0.75; here again we are admittedly dealing with approximations only. It is also to be noted that poops, bridges, forecastles and deck houses complicate the situation, all of which Mr. Tobin automatically takes care of.

Method of Reducing the Chance of Error

The present problem is to get away from the big guess at "A" referred to above and by making approximations at the difficult factors reduce the chances of error by making little guesses at each factor instead of a blind stab at one big variable. It will be further noted that it is only the square root of these approximated factors that concerns us; as we know, we can have quite appreciable errors in a figure which become less formidable when we use the root. For example, 3,000 = 2,000 plus 50 percent, but

$$\sqrt{3{,}000} = \sqrt{2{,}000} + 22\tfrac{1}{2} \text{ percent}$$

With our usual shipbuilder's caution, we don't want the exact revolutions per minute at which to look for trouble. What we want is an idea of it and then we give it as wide a berth as we decently can. We don't get 90 revolutions per minute as the trouble point and then say that we will design for 88; the older heads among us would say that 80 is the figure with a red flag at 90.

It is suggested that in design work the range of revolutions per minute to be avoided be taken as from 10 percent below the calculated figure to 10 percent above. This will allow for the secondary corrections noted in Tobin's paper, variations in loading and lack of sureness in the method as proposed. Gümbel suggested a greater range; the writer's experience, admittedly limited, but based on Tobin's later paper, encourages the use of the smaller range.

Concrete Examples

Now for concrete cases; the interested reader is referred to Mr. Tobin's paper for a full account of the method, as repetition would be waste of space here.

The formula is:

$$P = \frac{n^2}{2\pi}\sqrt{\frac{EIg}{\Delta L^3}} \times 60$$

where, P = period frequency per minute.
n = numeral depending on mode of vibration, being 4.73 for 2 nodes, 7.8532 for 3 and 10.9956 for 4 nodes.
E = modulus of elasticity, taken at 11,000, as explained above.
I = mean moment of inertia, square inches feet squared; and equals 60 percent of midship "I" for 0.45 block, increasing in a straight line to 84 percent for 0.75 block.
Δ = displacement in long tons.
L = length in feet.
π = 3.1416.
g = acceleration due to gravity.

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Using this on a 360-foot single deck collier which had decided two nodal vibration at 82 revolutions per minute we get:

$$P = 214 \times \sqrt{\frac{11{,}000 \times 173{,}500 \times 32.2}{9{,}500 \times 44{,}700{,}000}}$$

(This being a single screw ship the length between perpendiculars of 360 feet was cut to 355 feet to allow for the propeller arch.) Solving, $P = 214 \times .381 = 81\frac{1}{2}$. Another case was a 350-foot vessel of the channel steamer variety which vibrated in a decided manner at 88 revolutions per minute. She checked out as follows:

$$P = 214 \times \sqrt{\frac{11{,}000 \times 95{,}000 \times 32.2}{4{,}850 \times 41{,}064{,}000}} = 214 \times .411 = 88.$$

It is submitted that by splitting up the guess-work ("guess" is here used in a different sense to "blind-stab") as explained above, two remarkable checks on observed results have been obtained and in a thoroughly practicable design stage manner.

A word as to calculating "I"; there are many refinements possible, but the method laid down in the proposed (British) regulations for an international load line (1916) has been followed as quick and quite close enough.

As to the character of vibration to be allowed for: the two node vibration may be far enough to go for steam reciprocating engines in cargo ships, the three and even four node conditions must be looked into for Diesel jobs, liners and all small quick running jobs. This involves no more work, the variation in "n" factor, given above, makes only a few more slide rule manipulations necessary.

The writer by no means advocates the elimination of Mr. Tobin's full method for actual ships, and particularly Diesel jobs with revolutions per minute in vibrationally uncharted regions; this is suggested as a quick way to check up design fundamentals, before a shipyard finds itself in a tight place.

Mr. Tobin instances a liner where the "p" factor was of the order of 0.75; the above approximations checked this in an uncanny way on a 300-foot vessel.

No approximate formula in engineering is any good until it has been submitted to the hard knocks of experience, and further examples from the reader's experience would be valuable to the profession as a whole, just as much the disagreements as the agreements, perhaps more so, in fact. Vibration is an extremely difficult and complex problem. The writer has not forgotten the old adage about those who rush in where angels fear to tread; he has written the above for the good of the profession with some fear but with the hope that he has landed in a middle ground position which will stand up under the light of the experience of others, even though it is admittedly a position that is not mathematically proven.

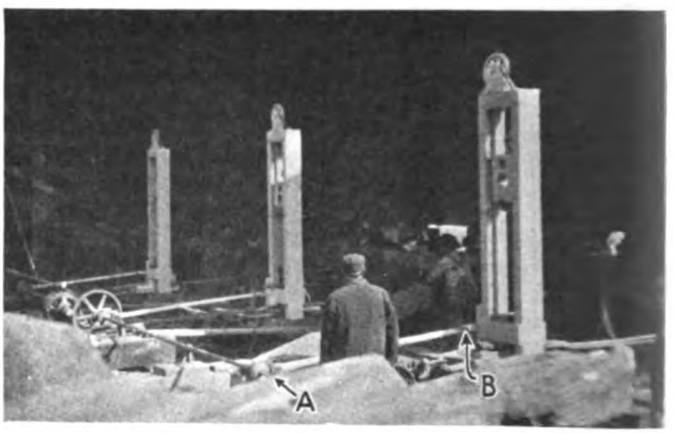
It will be noted that this paper covers vertical vibrations due to bending only; torsional vibration troubles are less likely to give trouble as reduction gears replace direct drive turbines; they are to be guarded against in all high speed jobs, however. As shown by Gümbel in his 1912 paper they may be expected to develop at frequencies between $4\frac{1}{2}$ and $5\frac{1}{2}$ times as high as the natural or vertical critical periods. The torsional frequency must be divided by the number of blades in the propellers, usually three in the cases we are considering, so that possible trouble from this source is by no means to be lightly passed over. Revolutions per minute multiplied by the number of blades per propeller gives the impulses per minute imparted to the hull tending to produce torsional vibration; it emphasizes the importance of adequate tip clearance between propellers and hull.

The paper read by Mr. N. W. Akimoff before the Society of Naval Architects and Marine Engineers in 1918 illustrates well the difficulties of an actual set of calculations for a ship.

Unique Electrical Device Used in Launching First Ford Motorship

AT the request of Mr. W. B. Mayo of the Ford Motor Company, a departure from the present method of launching was introduced when the first Ford motorship, the *Henry Ford II,* was launched on March 1 at the Lorain, O., yard of the American Ship Building Company. The ship was launched electrically by means of a switch, and the method of accomplishing this was unique in a way, inasmuch as the guillotine of the eighteenth century and the electric motor of the present day were combined.

Three guillotines were placed over the releasing ropes at the bow of the ship and three over those at the stern. The knives were weighted and suspended by means of ropes



Forward Guillotines

Notice motor connecting the three guillotines on one shaft. A—Eccentric for pulling pins. B—Pin releases rope holding guillotine.

passing over sheaves at the top of the guillotines. These ropes were secured by a bolt attached to connecting rods working upon eccentrics on a shaft common to all three connecting rods. This shaft was rotated through gears by a motor at a speed of 60 revolutions per minute. At this speed it can readily be seen that the motors did not reach their maximum speed before the knives had been released.

The starting of the motors was under the control of the sponsor of the ship. Located amidships, on the launching master's stand, was a specially designed switchboard which assured the simultaneous operation of the two motors. When the launching master was convinced that all was in readiness to proceed with the launch, he closed the main line switch, which flashed a signal to the launching stand and furnished current to the switch which the sponsor of the ship controlled. The closing of this switch energized the switchboard contactors and caused the motors to function.

As each individual rope was cut it was indicated at the switchboard. The cutting of the six ropes, forward and aft, was done simultaneously and a perfect side launch resulted. It is stated that three seconds after Mr. Mayo, of the Ford Motor Company, closed the launching switch, the ship was on its way to join the many other ships of the Great Lakes.

NAVIGATION OPENS ON GREAT LAKES.—The first Great Lakes vessel to deliver a cargo of bituminous coal to the northwest this season was the *Thomas Shaughnessy,* which arrived in Milwaukee, April 18, with a cargo for the Milwaukee Western Fuel Company. The vessel loaded in Toledo. Inbound navigation at the Canadian head of the Great Lakes was opened at Port Arthur, April 21, with the arrival of the steamer *Huronic* from Sarnia, the first time a passenger boat opened the season from the lower lakes.

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Government Supervision of Shipping in England

We have always looked upon the British Board of Trade as an admirable institution, and have felt that a similar coordination in this country of all governmental agencies having to do with mercantile marine affairs would be of the greatest advantage to all concerned. There is to be considered, however, the danger that government supervision may easily be carried too far and become a hindrance rather than a help. The following abstract of a paper read before the Institution of Engineers and Shipbuilders in Scotland by Mr. Frank R. Blair indicates a condition in British shipbuilding affairs which merits careful consideration on the part of those who are planning the proposed consolidation of the various supervisory departments of the government in this country.

ONE remarkable feature of modern industrial life in Great Britain is the increasing tendency of Government to interfere in the conduct of industry. If this interference was the result of considerate thought and care for the well-being of industry and for the prosperity of the country, and was kept within reasonable limits, it would be welcomed by all concerned. A careful examination, however, of the mass of hasty and ill-digested Acts of Parliament which have been passed during the last few years does not lead to the conclusion that the country's welfare is the sole governing consideration. The Government department which attends to the important industry of shipbuilding is the Marine Department of the Board of Trade, and this paper proposes to examine a few of its later activities and consider their effect on the shipbuilding trade of the country.

A measure of Government control of shipping has been found necessary from the earliest times. The modern history of ship regulations in this country may be said to begin with the Merchant Shipping Act of 1854, which codified the laws of shipping and introduced the present system of tonnage measurement.

Up to the year 1912, the Board of Trade was a fairly reasonable and law-abiding body. When an alteration of the rules was contemplated, the matter was investigated; the Board refusing to yield to popular (and usually ignorant) clamor.

Titanic Disaster Increased Life Saving Requirements

A new era began, however, with the loss of the *Titanic* in April, 1912. This disaster, the circumstances of which were altogether exceptional, has been treated as an ordinary sea risk, and resulted in a mass of enactments on boats and bulkheads which can only be described as panic legislation.

The cry "boats for all" went up, and the Board of Trade at once yielded to the uninformed clamor. Circular after circular was issued (without notice), and the supplying of a new ship with boats to comply with the latest law, even for a simple cargo-steamer, became at once a very difficult problem.

In 1914 the Board of Trade issued new rules for Life Saving Appliances, which are in force at the present time. The boats' outfit was increased, and boats and lowering gear were required to be strong enough to stand lowering with the full complement of persons on board. The outfit takes up so much room that a Class I lifeboat appears well loaded, especially in the smaller sizes, before any person is put into it. It is almost pathetic for a shipbuilder to see, in a light-scantling smooth-water river steamer, a lifeboat with full Western ocean scantlings, crammed with sea-going gear and fitted with heavy davits, blocks and falls, when he thinks of the anxious hours spent in eliminating every redundant weight throughout the ship.

In 1920 the Board of Trade produced the "Instructions as to the Survey of Life Saving Appliances," a monumental volume of 160 pages, of a truly Teutonic thoroughness in its wealth of detail and lack of flexibility. This publication standardizes the proportions, scantlings, etc., and literally specifies the size and position of every nail in the boat, and effectually blocks all chance of improvement in the construction of ships' boats.

It seems to me that this goes far beyond the proper functions of the Board of Trade or any Government department, whose province should be to lay down conditions, not to prescribe methods.

Bulkhead Regulations

We now come to the greatest achievement of the Board of Trade, namely, the bulkhead regulations, issued in 1915. These "Instructions relating to the Construction of Passenger Steamships," which impose elaborate restrictions, appeared in the early stages of a great war, when the country's need was for the utmost rapidity in ship construction.

Following on the *Titanic* disaster, the Board of Trade, in May, 1912, appointed a committee to inquire into the construction and spacing of watertight bulkheads.

In November, 1913, an International Conference on the Safety of Life at Sea assembled in London, and appointed a Convention. Regulations were drawn up regarding various matters pertaining to construction and operation and including subdivision and construction of watertight bulkheads. The findings of this Convention were sent by the Board of Trade, in January, 1914, to the Bulkhead Committee to be taken into consideration in their report.

The Bulkhead Committee submitted their first report, which dealt with foreign-going passenger steamers, in November, 1914. The second part of their report, dealing with home trade and cargo steamers, was not issued till August, 1915. The committee produced an ingenious set of flooding-curve diagrams, from which a flooding curve for a new vessel can easily be made out, provided dimensions, draft, arrangement, and model are fixed, and detailed plans available. This is the point where their methods break down in practice, because in the early stages of a design, and more particularly for a tender, these particulars are not fixed accurately enough for the Bulkhead Committee's methods.

The effect of the Convention and the Bulkhead Committee's Report as applied by the Board of Trade has been to produce a scheme for fixing subdivision which is quite unsuitable for ordinary shipyard conditions as they exist today, and which I think all practical ship designers and builders will unite in condemning.

The principle of having passenger ships reasonably well subdivided is admitted by everyone, and is more or less everybody's, that is to say, Government's business, but the method of arriving at that result is of vital concern to shipbuilders.

What shipbuilders require is a simple, rapid method of fixing bulkheads for good, in the early stages of a design, and the Board of Trade, in adopting the Bulkhead Committee's methods, have not given it to them.

The Bulkhead Committee may claim that their method is as simple as the nature of the subject permits. That may be so, but it is not so simple as the nature of the case *requires*. I have not the slightest doubt that the committee could devise a simple rule based, say, on length, sheer and freeboard ratios,

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and block coefficient with an approximate permeability, or even some simpler method which would fix the bulkheads easily in the early stages of a design.

There might be some justification for the Bulkhead Committee's methods if they really gave the measure of safety that the special safety certificate will undoubtedly lead the public to imagine. But do they? In the Bulkhead Committee's own words:

"Even if methods of complete accuracy could be employed, the safety attained by the application of any given standard of subdivision can only be relative and conditional, and complete protection against the result of all possible varieties of accident is unattainable in practice. The formulation and enforcement of rules governing subdivision is a contribution of the utmost importance to the safety of life at sea, but as regards the result of such rules in any particular case, it is not possible to say more than that, if the damage does not exceed a specified amount, and if the assumptions made in the rules are not materially departed from, the vessel may be reasonably expected to remain afloat."

For this qualified and theoretical safety, I consider that all these elaborate and time-consuming methods are quite unjustifiable. They have increased the time required to build ships, added to their cost, and even in some cases prevented their being built.

The Board of Trade may consider that they are only acting in the interests of the traveling public, which it is their duty to safeguard, but has it no duties to anyone other than the traveling public? The following remarks by Sheriff Fyfe of Glasgow, in his judgment on a Court of Survey held in 1904 bear up on this point:

"Although the Board of Trade has a great duty to the traveling public who use passenger steamers, the Court ventures humbly to think that the Board has also a responsibility to the shipbuilding and allied industries. If it appears that in their zeal for the public safety the Board officials are unnecessarily imposing restrictions upon an industry, the Court, however reluctantly, cannot escape adversely reviewing the official action."

Multiplicity of Inspectors a Hindrance

An irritating and expensive feature of Government control of shipping is the multiplicity of inspectors. Besides the Board of Trade surveyor, there are the sanitary authorities, the Board of Agriculture, and the factory inspector. The sanitary inspector is necessary for medical reasons, but the two others are redundant, and their duties should be performed by the Board of Trade surveyor.

Factory legislation may be suitable for shore work, but is farcical when applied to a ship. A seaman, while his ship is steady in dock has to have a gangway to board her, with double rails 2 feet 9 inches high on each side. Hatches have to be fenced with rails if the coamings are less than 30 inches in height. He is not supposed to go on a hatch beam to fasten the slings, and generally is hampered by regulations which might be made by old women for toddling infants. In a few hours he may be at sea, ordered up a reeling mast and out on the slender footrope of a topgallant yard, trusting his life to a seizing of a few turns of marline, and accepting cheerfully risks which are fifty times greater than in harbor.

A few simple safety regulations made by practical men and administered by the Board of Trade are all that is required.

Regulations for Housing Seamen Impractical

Recently we have had the new "Instructions as to the Survey of Crew Spaces." These "Instructoins" are a good example of the present methods of the Board of Trade. They are an elaboration of the old rules, and introduce some new cast-iron regulations, as to what the Board considers advisable for the housing of seamen. The seamen's ideas, I fancy, will not be exactly the same. For instance, lining on ships' sides is to be discouraged, all berths are to be made of metal, and internal bulkheads of steel. Some sailors have a strong objection to being compelled to sleep in a metal bunk, and an equally strong objection to living in an unlined forecastle in the Red Sea or Persian Gulf, for reasons obvious to anyone who has experience of these conditions. The regulations are no doubt made for sanitary reasons, but the problem has been attacked from the wrong end. Why not restore the power of the master to enforce discipline, and compel the crew to keep their quarters clean, instead of allowing the men to live in filth, and attempt to keep them healthy by making everything of metal.

The shipbuilding industry in this country is in a perilous state today, crippled by many different causes. Among these is, I believe, recent Board of Trade action. We shall have in future to face far keener competition than in the past, and all obstacles to rapid and economical production should be removed as far as possible.

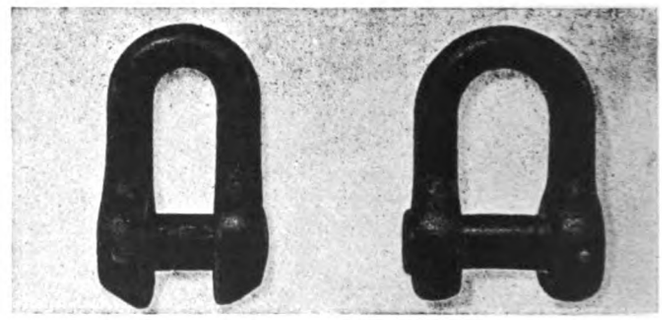
I need hardly say that what is being attacked is a system, not individuals. The system of continual and increasing Government interference with the details of shipbuilding, even if it springs from the best of motives, I believe to be prejudicial to the development of the industry and to prosperity of the country, which so largely depends on sea transport.

New Shackle Reduces Chain Losses

As a result of several years' experimental work the National Malleable Steel Castings Company, Cleveland, Ohio, has developed a new anchor and chain shackle that is stronger and has proven superior in service in many respects to the old type. In altering the old-style design, the width has been reduced between shackle jaws, the ends beveled off, a large locking pin used, and an entirely different style of shackle pin fitted.

In the course of investigation the manufacturers found that a large percentage of chain losses were caused by defective equipment and not by chain breakage.

The advantages claimed as a result of the changes are



New Style Old Style

that the bending moment on the shackle pin has been reduced by the reduction in width of the shackle, making a stronger shackle. The larger and stronger locking pin prevents spreading. The beveled end reduces the possibility of shackles catching in the hawse pipe when the chain is being heaved in and increases the strength of the shackle at the point of greatest stress. Reduction in width of the anchor or bending shackle also prevents it from getting crosswise with the chain and anchor and insures a pull in the right direction.

The modified type is also provided with a *V* shoulder which permits the pin head to set down into the jaw of the shackle and thus eliminates the otherwise necessary projection.

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Modern Tendencies in Steam Turbine Power Plants*

Advantages Obtained in the Adoption for Marine Propulsion of High Steam Pressure, High Superheat, Steam Extraction for Heating Feed Water and Reheating

By Eskil Berg†

In a recent editorial, we drew attention to the possibility of increasing the economy of marine steam plants by the adoption of certain of the methods employed in large power houses. We also mentioned the all-important necessity of reliability in these plants and the danger arising from increased complications and the effect of trying sea conditions upon apparatus which may function in an entirely satisfactory manner on shore.

Furthermore it must be remembered that capital charges are often quite as important as operating costs and we fear that, in a final analysis, Mr. Berg's indicated savings would have to be seriously modified.

It may be, however, that with the greatly reduced water rates, which are given in the paper, boilers and condensers could be of much smaller dimensions than are now found necessary, and the first cost thus kept at a reasonable figure.—*The Editors.*

THE importance of the adoption of high steam pressure, high steam temperature, reheating of steam and steam extraction is probably best illustrated by the fact that today in this country we are building six very large central power stations in which all these features have been adopted. The steam turbine today has reached a point of development where its efficiency is within a few percent of that theoretically obtainable; further improvements in the turbine itself cannot materially reduce the fuel consumption, and increase in economy must be sought as the result of improved steam conditions.

The more energy (B.T.U.) we can supply to each pound of steam before it enters the turbine, the less number of pounds will naturally be required to produce the unit of power (kilowatt hours). To supply more energy to a pound of steam means to raise its temperature. This can be done either by raising the steam pressure, adding superheat or doing both. Steam can also be extracted from the turbine at some lower pressure, then reheated and led back to the turbine.

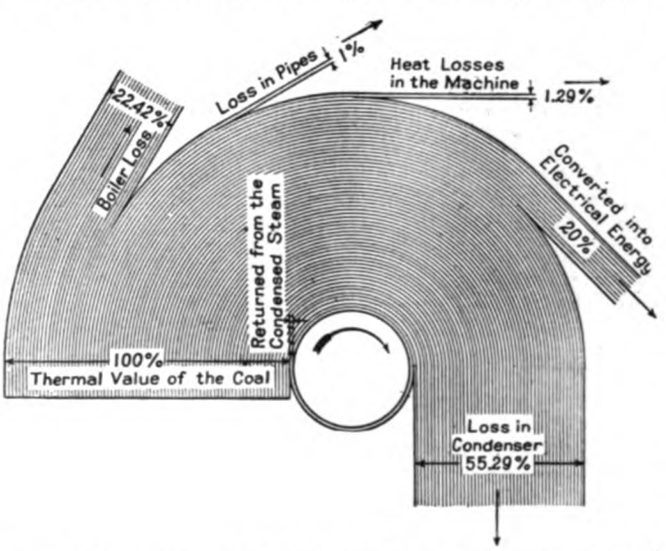

Fig. 1.—Graphic Representation of Distribution of Energy of 1 Pound of Coal in First-class Power Station (250 Pounds Pressure, 200 Degrees Superheat and Good Vacuum Conditions)

Fig. 1 represents graphically how the energy of a pound of coal is distributed in a first-class power station using 250 pounds pressure; 200 degrees superheat and under good vacuum conditions.

This shows that 20 percent of the energy in the coal is converted into electrical energy, which figure corresponds to 17,075 B.T.U. per kilowatt hour. This is about the lowest figure at which power has been produced under the above steam conditions.

It will also be noted that the condenser loss amounts to 55.29 percent of the heat value of the coal. With this picture in view, it is obvious that the better the steam consumption is per kilowatt hour, the less steam goes to the condenser.

Only a few years ago it was considered good practice to produce a kilowatt hour with 14 pounds of steam going to the condenser. Today, with the adoption of high steam pressure and superheat, reheat and bleeding the turbine for heating the feed water, this figure has been more than cut in half, which means that the condenser loss is practically reduced in the same proportion.

Gain by High Steam Pressure

The total heat of steam gradually increases with the pressure until it reaches its maximum at 370 pounds absolute and remains constant up to 395 pounds absolute, after which it decreases. At 1,200 pounds pressure the total heat is only 1,179.7, which is the same as at 62 pounds absolute. (Goodenough's steam table.)

Table I shows the theoretical gain by raising the steam pressure. Two hundred pounds has been taken as the starting point and the available energy is given from one pound of steam expanded adiabatically down 28.5 inches vacuum.

Table I

Absolute Pressure, Pounds	Corresponding Temperature, Deg. F.	Total Heat	Increase in Total Heat, Percent	Available Energy in Ft. Lb. Expanding to 28.5 In. Vacuum	Increase of Available Energy, Percent	Net Gain in Fuel, Percent
200	381.9	1,198.5	....	272,000	....	....
300	417.5	1,201.9	0.28	293,000	7.72	7.44
400	444.8	1,202.5	0.33	304,500	11.95	11.62
500	467.2	1,201.7	0.27	312,000	4.7	14.43
600	486.5	1,199.8	0.11	319,000	17.2	17.09
700	503.4	1,197.4	0.902	325,000	18.7	18.79
800	518.5	1,194.4	—0.342	327,000	20.2	20.54
900	532.3	1,191.1	—0.617	329,000	20.9	21.51
1,000	545.0	1,187.6	—0.909	331,000	21.7	22.6
1,100	556.6	1,183.8	—1.225	335,000	23.2	24.42
1,200	567.7	1,179.7	—1.58	337,000	24.0	25.58

*Abstract of paper read before the metropolitan section of the American Society of Mechanical Engineers, New York, April 1, 1924.

†Marine engineering department, General Electric Company, Schenectady, N. Y.

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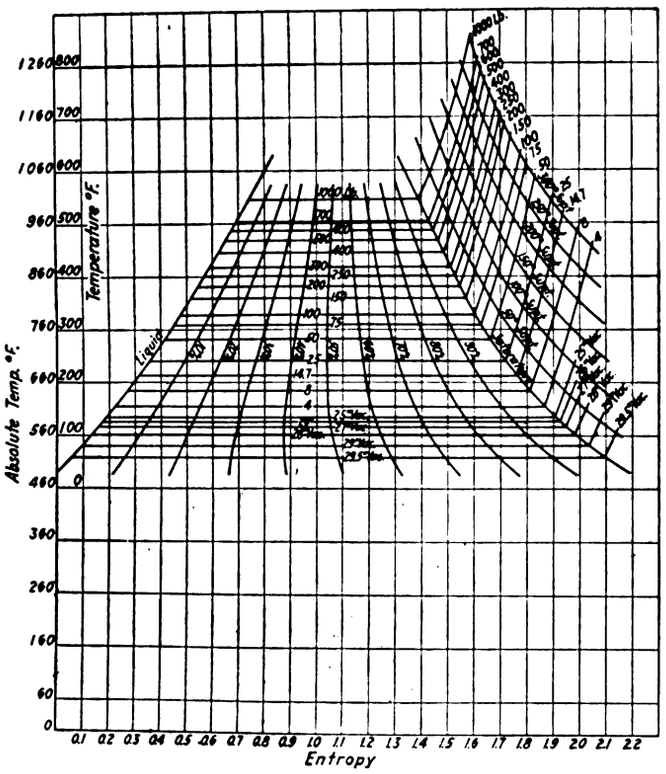

Fig. 2.—Temperature-Entropy Diagram (Values from Goodenough's Steam Tables, 1915 Edition)

It will be seen that by raising the steam pressure from 200 to 1,200 pounds the total heat is reduced from 1,198.5 B.T.U. to 1,179.7 or 1.58 percent, while the energy increases from 272,000 to 337,000 foot pounds, or 24 percent, the net gain being 25.5 percent.

High Superheat

The theoretical gain by the use of superheat is almost negligible, as will be seen by Table II. There is, however, a practical gain in its adoption which makes superheat necessary. It is shown by the entropy diagram, Fig. 2, that the moisture in the exhaust increases as the initial pressure is increased. Moisture in a turbine affects its efficiency very materially and is the greatest source of loss.

In an average, well-designed turbine of the impulse type, when dry initial steam is used, the losses are as follows:

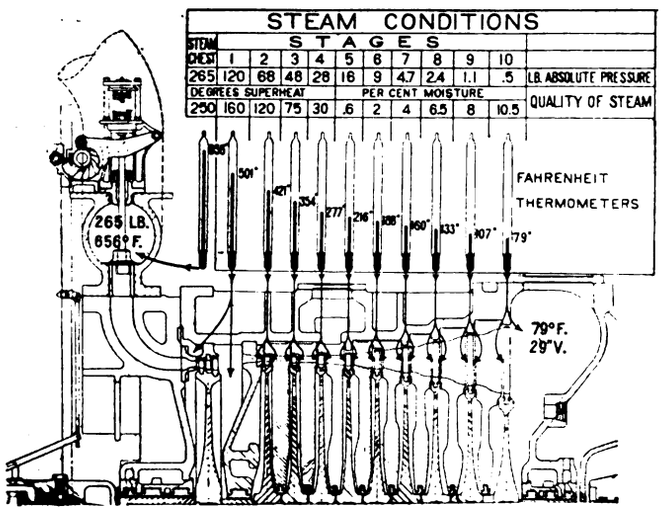
STEAM CONDITIONS
STEAM CHEST
STAGES
1 2 3 4 5 6 7 8 9 10
265 120 68 48 28 16 9 4.7 2.4 1.1 .5 LB. ABSOLUTE PRESSURE
DEGREES SUPERHEAT
PER CENT MOISTURE
QUALITY OF STEAM
250 160 120 75 30 .6 2 4 6.5 8 10.5
FAHRENHEIT THERMOMETERS
265 LB.
656° F.
79° F.
29" V.

Fig. 3.—Cross Section of 10-Stage Turgine, Showing Approximate Condition of Steam in All S

Table II. Superheat (250 Pounds Pressure, 28½ Inches Vacuum)

Deg. Superheat	Temp.	Available Heat	Corresponding Ft. Lb.	Total Heat	Percent Increase in Fuel to Produce Superheat	Percent Increase Available Energy Due to Superheat	Net Theo. Gain Percent	Decrease in Water Rate Percent	Actual Gain Percent
0	406	369.9	288,000	1,201.1	....	....	....	..	....
50	456	381.4	297,000	1,233	2.66	3.11	.45	4	1.3
100	506	393.5	306,000	1,264	5.25	6.38	1.14	8	2.7
150	556	405.9	316,000	1,292	7.57	9.74	2.17	12	4.4
200	606	418.7	326,000	1,320	9.90	13.22	3.32	16	6.7
250	656	431.8	336,500	1,346	12.08	16.75	4.67	20	7.4
300	706	445.3	347,000	1,374	14.40	20.4	6.00	24	9.0

	Percent
Loss due to friction in nozzles and blades and windage loss of disks and blades	3
Steam leakage loss	3
Rejected energy (due to residual steam velocity)	3
Bearings, packings, etc.	1
Total loss	21
Efficiency of turbine	79

It will be seen that the first item is by far the largest and the moisture in the steam in all the stages has greatly increased this loss. If, on the other hand, steam instead of being dry had entered the turbine with 200 degrees of superheat, it would be found that this loss would be reduced from 20 percent to about 15 percent, and the turbine efficiency increased from 73 percent to 78 percent, a very appreciable saving due to superheat.

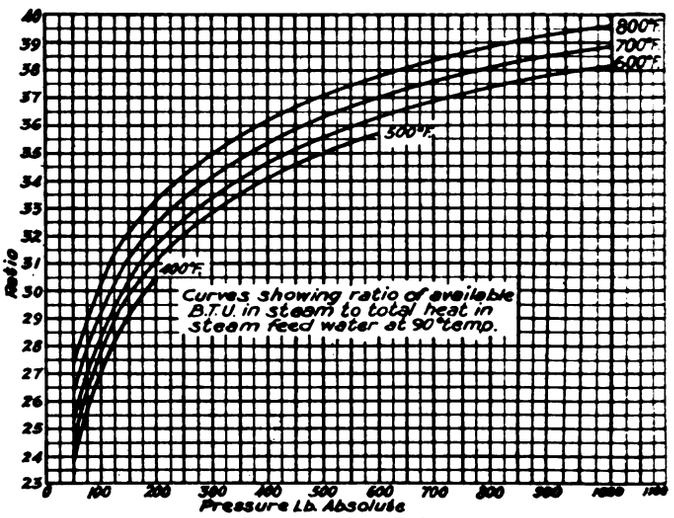

Fig. 4.—Ratio of Available British Thermal Units in Steam to Total Heat

Fig. 3 shows a cross section of a turbine having 10 stages and gives approximately the condition of the steam in all the stages. This turbine has 80 percent efficiency and is supplied with steam at 250 pounds gage pressure—250 degrees superheat and is exhausting into the condenser at 29 inches of vacuum.

Table III gives a comparison of the steam conditions when supplied with 250 degrees superheated steam and when supplied with initial dry steam.

Table III.—Table Comparing Quality of Steam in Various Stages When Dry Initial Steam and Steam Having 250 Degrees of Superheat Is Used

Stages	1	2	3	4	5	6	7	8	9	10
Quality of Steam	—				—Percent Moisture—					
Dry initial	4.4	6.8	8.15	9.8	11.5	13	14.5	16	17.3	18.7
Quality of Steam	—Degrees Superheat—					—Percent Moisture—				
250 degrees superheat	160	120	75	30	.6	2	4	6.5	8	10.5

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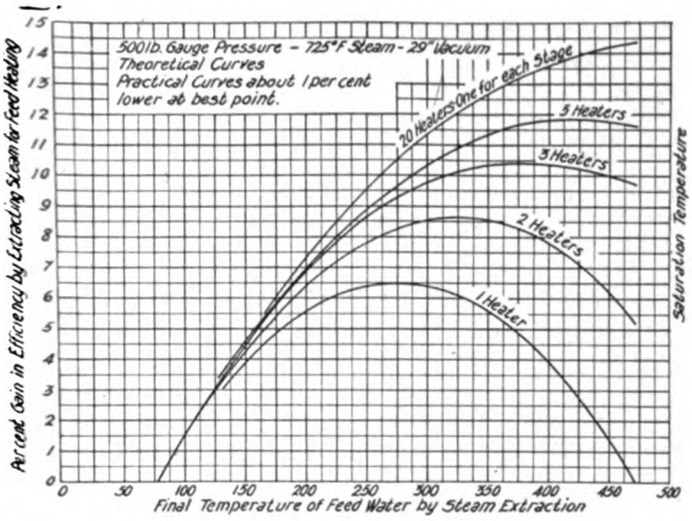
500lb. Gauge Pressure - 725°F Steam - 29" Vacuum
Theoretical Curves
Practical Curves about 1 per cent lower at best point.
20 Heaters One for each stage
5 Heaters
3 Heaters
2 Heaters
1 Heater
Percent Gain in Efficiency by Extracting Steam for Feed Heating
Saturation Temperature
Final Temperature of Feed Water by Steam Extraction

Fig. 5.—Approximate Theoretical Gain by Use of 1, 2, 3, 5 and 20 Heaters

GAIN BY HIGH STEAM PRESSURE AND SUPERHEAT COMBINED

Fig. 4 gives the ratio of available B.T.U. in steam to the total heat, giving credit for the heat in the condensate which is returned at a temperature of 90 degrees F.

Up to the present time the standard steam pressure for large power stations has been 250 pounds with superheat of about 50 pounds pressure. The volume of the steam at this this gives a ratio of 32.8 percent.

At the present time several large stations are building in this country which have adopted 550 pounds pressure and 725 degrees initial temperature. From the curve this gives a ratio of 36.9 percent. With the same turbine and boiler efficiencies this would mean a saving of as much as 12.2 percent.

The ratio 36.9 would give a kilowatt hour, assuming a turbine efficiency of 75 percent and boiler efficiency of 80 percent, with $36.9 \times .75 \times .80 = 22.2$. As one kilowatt hour = 3,415 B.T.U. this corresponds to $\frac{3,415}{222} = 15,350$ B.T.U., to which has to be added about 5 percent for station auxiliaries, making a total of 16,100 B.T.U.

STEAM EXTRACTION

A very large gain in efficiency is made in the cycle shown in Fig. 4 by extracting steam for heating the feed water from several stages in the turbine.

Fig. 5 shows approximately the theoretical gain by the use of 1—2—3—5 and 20 heaters. While these curves are calculated for 500 pounds gage—700 degrees and 29 inches vacuum, they can be used with comparatively small error for other pressures and temperatures. If the steam is initially dry, the gain would be larger than what is shown but only by a couple of percent.

The extraction of steam for heating feed water has also an important gain, namely: the more steam we extract from the turbine before it reaches the condenser, the less steam naturally goes to the condenser, which means a corresponding reduction of heat loss from this source.

REHEATING

From a glance at the entropy diagram, Fig. 2, it will be seen that, when adopting pressure of 500 and above, there will be excessive moisture in the low pressure end of the turbine. Reheating is, therefore, more advisable under those steam conditions than when lower steam pressure is used, although at the lower pressure it is also advisable. But, with low initial pressure (250 pounds) the reheating is done at about 50 pounds pressure. The volume of the steam at this pressure is rather large, requiring a large size reheater to prevent excessive drop in steam pressure. The most economical pressure at which to do the reheating varies but, as a rule, it will be found to be around one-fifth of the initial boiler pressure.

Theoretically, as with initial superheat, the gain is small, being about 3 percent, if the steam is extracted at one-fifth the initial pressure and reheated to the original temperature. The decrease in water rate is, however, about 4 percent, due to reduction of friction losses in the turbine. There is, of course, a slight pressure loss due to the piping and the reheater itself, so that the net gain in efficiency will be about 6 percent.

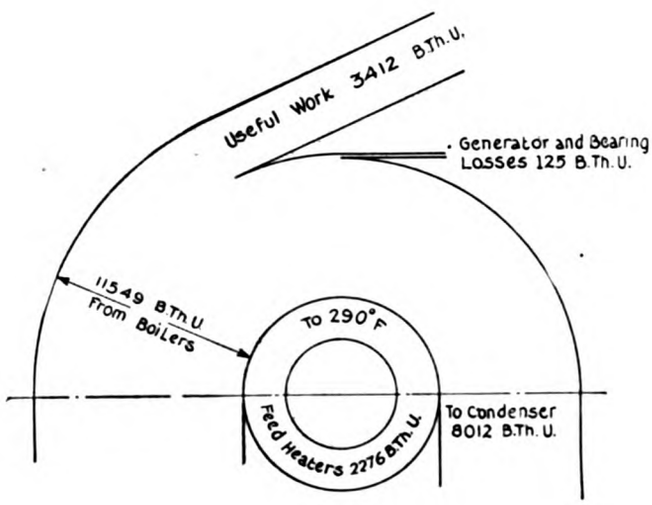
Useful Work 3412 B.Th.U.
Generator and Bearing Losses 125 B.Th.U.
11549 B.Th.U From Boilers
To 290°F
Feed Heaters 2276 B.Th.U.
To Condenser 8012 B.Th.U.

Fig. 6

Heat distribution per kilowatt generated of 20,000 kilowatt, 1,800 revolutions per minute turbine, 350 pounds gage, 725 degrees F. temperature, 29 inches vacuum. Efficiency $= \frac{3412}{11549} = 29.54$ percent. For fuel consumption, efficiency of boiler must be allowed for, also auxiliaries.

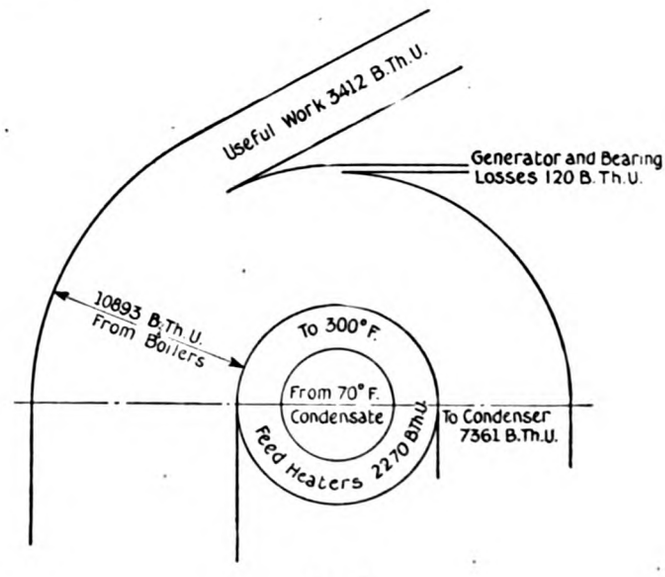

Fig. 7

Heat distribution per kilowatt generated (interheater out of action) of 20,000 kilowatt, 1,800 revolutions per minute turbine, 550 pounds gage, 725 degrees F. temperature, 29 (30) inches vacuum. Efficiency $= \frac{3412}{10893}$ = 31.32 percent. For fuel consumption, efficiency of boilers must be allowed for, also auxiliaries.

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ECONOMIZER

Steam extraction from the turbine for heating the feed water is so efficient that the use of economizers would seem unnecessary. However, the flue gas temperature must be kept low in order to keep the efficiency of the boiler plant high. Thus, if economizers are omitted, the waste heat from the gases must be used to preheat the air going to the boilers.

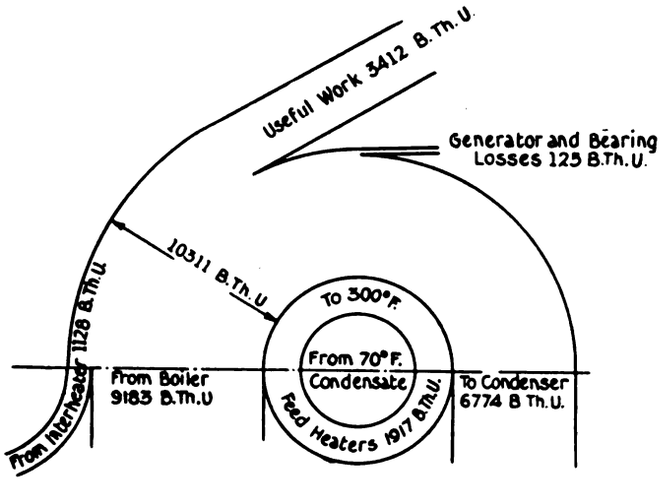

Fig. 8

Heat distribution per kilowatt generated (interheater in action) of 20,000 kilowatt, 1,800 revolutions per minute turbine, 550 pounds gage, 725 degrees F. temperature, reheat to 725 degrees at 100 pounds, 29 (30) inches vacuum. Efficiency $= \frac{3412}{10311} = 33.09$ percent. For fuel consumption, boiler and interheater efficiency must be allowed for, also auxiliaries.

Grate manufacturers at the present time prefer to limit the temperature of the air to 300 degrees F. or below. However, with oil or powdered coal, high air temperature has proved rather beneficial.

Fig. 6 gives the typical heat balance of a turbine designed for 20,000 kilowatts and 1,800 revolutions per minute when operating with 350 pounds gage pressure—725 degrees F.

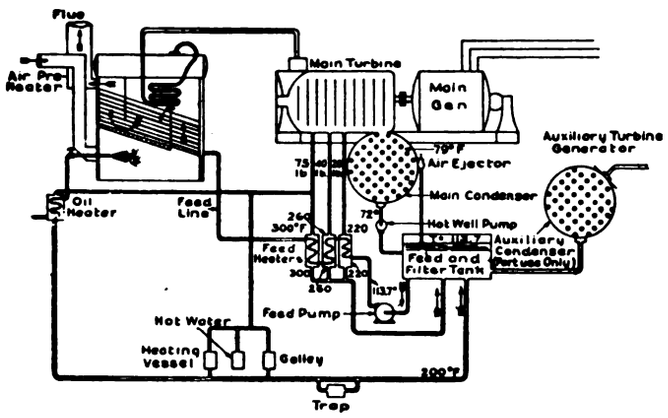

Fig. 9

temperature steam and 29 inches vacuum, with no reheat, but with steam extraction to heat the feed water to 290 degrees F. It shows that one kilowatt hour may be produced with 11,549 B.T.U. from the boilers. For fuel consumption the efficiency of the boilers and power taken by auxiliaries must be allowed for. Fig. 7 gives the heat balance of the same turbine designed to operate with 550 pounds gage—725 degrees F. steam temperature and 29 inches vacuum. Steam is extracted to heat the feed water to 300 degrees F. With this arrangement a kilowatt hour may be obtained with 10,893 B.T.U. from the boilers.

Fig. 8 gives the heat balance of the same turbine designed for reheating the steam to 725 degrees at 100 pounds gage and gives one kilowatt hour with 10,311 B.T.U. This figure, assuming 80 percent boiler efficiency and 6 percent for auxiliaries, would mean 13,700 B.T.U. from fuel. With oil or powdered coal, where full advantage can be taken of air preheating, the boiler efficiency may reach as high as 90 percent in which case the fuel consumption would compare favorably with that of Diesel engines.

50,000 HORSEPOWER TWIN SCREW LINER

(Propeller speed, 120 revolutions per minute.)

The equipment consists (Figs. 9 and 10) of two turbine generators, each of which is capable of delivering 25,000 shaft horsepower to the propeller shaft as well as furnishing power for driving the auxiliaries: approximately 2,200 kilowatts.

Two 25,000 horsepower synchronous motors; one for each propeller shaft.

Two motor generator sets, each consisting of AC motor and AC generator, having a capacity of 2,000 kilowatts at the generator,—one being a complete spare.

Two motor generator sets of 500 kilowatts, each consisting of AC motor and DC generator, one of these as a spare.

All these motor generator sets are also connected by means of clutches to steam turbines for port use or while maneuvering in harbor.

Boilers.—Eighteen watertube boilers have been assumed, each having 5,000 square feet of heating surface. Fifteen of these will be in operation and 3 boilers for spare. A conservative rating of the boilers has been given, namely: 6/10 of a pound of fuel oil per square foot of heating surface.

Air Preheaters.—Air heaters of the Howden-Ljungstrom system have been assumed, giving a stack temperature of about 300 degrees F.

Steam Extraction Heaters.—Three heaters have been used which will heat the feed water up to 300 degrees F. by extracting steam from three different stages in the turbine.

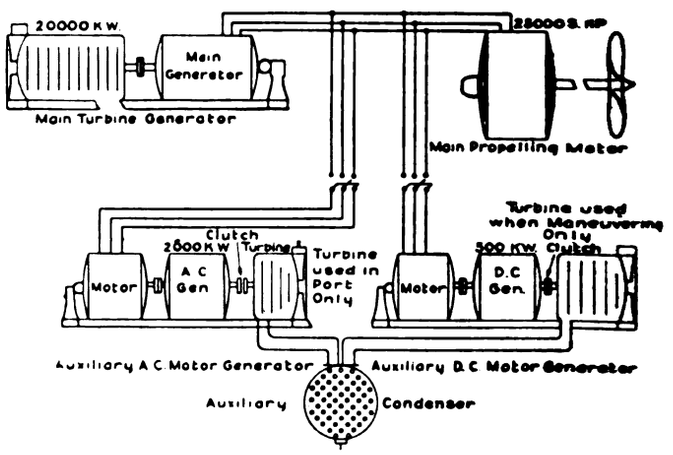

Fig. 10

3,500 pounds of steam per hour has been allowed for ship heating—175 kilowatts for various small electric heaters in various staterooms, etc., besides over 500 kilowatts for the steward's department of the liner.

Fuel Consumption.—It will be seen that the fuel consumption figure, 0.55 pound of fuel oil per shaft horsepower hour for all purposes, means that this vessel, when delivering 50,000 shaft horsepower to the propellers and driving all of its auxiliaries and lights, etc., will only consume 295 tons of fuel oil per day. No evaporators have been included in these figures.

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The above figures indicate the tremendous savings that may result from the adoption of this latest central station practice.

If, in addition, reheating at, say, 120 pounds pressure could be done without too much additional weight and complication, a further saving could be obtained of about 6 or 7 percent.

Boiler manufacturers are today willing to fully guarantee boilers up to working pressures of 1,200 pounds so that 550 pounds is conservative.

Turbine manufacturers also give full guarantee as to the operation of their turbines with the steam pressures and temperatures assumed. As all the auxiliaries are electrically driven, their reliability is unquestionable. Consequently all that remains is for the shipowner to adopt this system of efficient propulsion.

The author is very much indebted to Mr. F. V. Smith of the General Electric Marine Department for his great help in working out the heat balance of this 50,000 horsepower liner.

Electric Cooking for Marine Use

THE electrification of the marine field has broadened until it includes almost every mechanical operation on board a vessel. Up to the outbreak of the war, electricity had made most of its progress on war vessels but the post-war resumption of ocean passenger ship service renewed the study, by naval architects, of factors in ship design that effect comfort, safety and economical operation and has drawn their attention to the possibilities of electricity for cooking and similar services on commercial vessels.

Cooking by electricity has a number of inherent advantages: It is clean, there being no ashes or similar waste, there is no combustion with accompanying gases and fire risk, operation is quick, heating even and easily controlled, and, as the amount of heat used is directly proportional to the output, there is little waste heat and galley conditions are improved. Furthermore it is claimed that the shrinkage of meats and vegetables, when electrically cooked, is less than when coal or oil is used.

Comparing electricity with oil, there are claimed for electricity: Elimination of fuel, steam and air lines; elimination of high combustion temperatures and the corresponding erosion of metal and refractory linings; practical elimination of fire risk, with less supervision; decreased expense for ventilation and fire proofing and better working conditions in galleys. Against electricity—may be put down added wiring expense, additional generator capacity and higher first cost.

As a guide to the electrical demands of electric galley and bakery equipment, the following figures are taken from an actual installation on a large passenger vessel.

Bakery Load

Electric ovens are capable of producing about five pounds of breadstuffs per square foot of baking surface per hour. Based on a one shift bake, or effective work of seven hours, this would give a daily capacity of 35 pounds per square foot of baking surface. The average consumption is a pound of breadstuffs per person, per day. Each square foot of bake oven surface will take care of 35 people. The electric load per square foot of bake oven surface is 0.41 kilowatt maximum with an average of 0.25 kilowatt. So electric bake ovens will have a connected load of 1.20 kilowatts with an average demand of 0.75 kilowatt per 100 people.

Galley Appliances

The calculations are based on one four-foot range per 100 people served. This is equivalent to 22 kilowatts per 100 with an average demand of 13 kilowatts per 100.

Total Load

Summing up the above two factors and making an allowance for other devices such as broilers, toasters, griddles, etc., we can take as a safe maximum figure 24 kilowatts connected load of cooking appliances per 100 passengers with a demand of about 15 kilowatts per 100. Passengers and crew have been counted alike; the lesser consumption of breadstuffs by the passengers will be offset somewhat by their demand for more variety and pastry baking.

Electric Cooking Fuel Costs

Electric cooking costs on a large scale, whether on land or sea, will depend somewhat on the class of service and degree of supervision given to the work. Reasonable figures are from 1.0 to 2.0 kilowatt hours per person per day, the lower figure being easily attained when a simple schedule is used, while the upper represents "a la carte" figures. It is to be understood that in no case should electricity replace steam heat for low temperature heat such as coffee urns, stock kettles, warming closets, etc., except where isolation would mean expensive extension of steam lines (such as a special serving pantry or plate warmer for cabin service).

Based on contemporary data taken from recent reports covering oil burning ships with electric auxiliaries, the fuel consumed per kilowatt hour generated should be about 2 pounds of 14-16 degree Baumé oil or 0.25 gallon.

Thus, when feeding 1,000 people per day, the expected oil consumption would be for moderate cuisine:

$1{,}000 \times 1.50 \times 2$ or 3,000 pounds of oil.

$1{,}000 \times 1.50 \times 0.25$ or 375 gallons of oil.

Present prices are about 4 cents per gallon or ½ cent per pound, or $15.00 per 1,000 persons fed daily.

Bake Ovens

The electric bake oven was among the first electrical cooking appliances "to go to sea." Space limitations, ventilation

Fig. 1.—"Deck Type" Bake Oven

and the desire for bakery locations that exclude the use of fuel ovens have made electric bake ovens an effective tool for the ship designer and steward.

The figures illustrate certain cooking apparatus manufactured by the Edison Electric Appliance Company, Ltd., Chicago, Ill., which supplied the data upon which this article is based.

Fig. 1 describes the construction of the "deck type" oven, having two or more horizontal, tiled decks placed above each other and heated by separately controlled units placed above and below each deck. This arrangement of heat is the most

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direct and evenly distributed possible, since the heat is applied at the place where it is needed, *i.e.*, above and below the baking surface. Circulation of heated air, in imitation of fuel ovens, does not give nearly so uniform results and the concentration of heaters necessary to do this means higher operation temperature and maintenance.

The various decks of these ovens can be operated at widely different temperatures, thus giving great flexibility and control—which is especially desired when one oven must turn out all the various products required on board a first class ship.

The absence of much waste heat, the cleanliness and quick control have given the bake oven wide popularity in marine as well as shore bakeries.

Galley Range

A general view is shown in Fig. 2. The unit or section is four feet long. Each section has a top heating surface com-

Fig. 2.—Galley Range

posed of four 9-inch by 24-inch cast iron plates, into which has been cast a helico-spiral steel cased heating unit so the plate and unit are one. Each plate has a maximum of 4,000 watts, arranged for series parallel connection to give three heat control. The maximum temperature is about 900 degrees F. At this heat there is no distortion and a flat, uniformly heated cooking surface is thus assured. There are no "hot spots." The heating units are supported by two "tee"

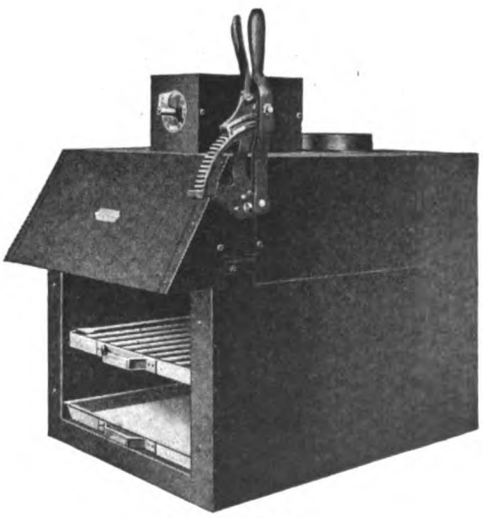

Fig. 3.—Broiler

bar saddles that extend to the base—the top sheet of the range does not support the cooking weight.

The oven is 18 inches by 21½ inches by 26½ inches deep, well insulated, and has two heating units—3,000 watts each, one at the top and one at the bottom. These units are readily renewable by loosening lead screws reached from the top of the range.

Each of the six units is controlled by a separate three-he metal handle snap switch. These switches are totally e closed, separately fused, and front connected for easy acce

These sections can be "banked up" to the required nu ber. Common ship practice is to have them "back to ba to conserve deck space.

Broilers

Fig. 3 shows a typical electrical broiler. These broil have an effective area 32 inches wide by 23 inches de heated by two 5,000 watt helical core sheathed wire u each 16 inches wide and separately controlled by an encl snap switch.

A new development is an electrically heated serving ta This is the conventional type of serving table for dini saloon use but has the additional feature of a "built-i metal hot top for keeping dishes warm while the previ course is served. There is also a demand for a similar p able device where meals are served in staterooms.

Dry Dock Control System Devised for Eliminating Ships' Strains When Docking in Floating Drydocks

IN order to permit of scientifically docking ships in floati drydocks, and to eliminate the strains incident to doc ing by the rule of thumb method, Charles Cory & Son Inc., 183 Varick street, New York City, manufactures a direct and remote reading electro-mechanical water lev indicating and dry dock control system. The function of th system is to determine the amount of water in each compart ment of a pontoon, from which can also be determined th weight of the ship being docked. The angular list of eac pontoon is transmitted in order that the dock may be set prop erly to receive the ship and care for the distribution o weights.

Means are also provided for determining the amount o opening of valves, and when the remote control of the pump ing motors is located adjacent to the Cory control switch board (which is installed at the docking master's position) the system in general will permit of practically every opera tion in connection with the docking of a ship being performed from the docking master's position.

The Cory water level indicating and dry dock control sys tem was invented by J. S. Jones, vice-president and genera manager of the Cory Corporation, who, in conjunction with the United States Government and ship dry docking com panies, made a very thorough and complete study of the re quirements for docking vessels.

The local indicators and remote transmitters, which are located on the drydock, consist of a pedestal on which is mounted a watertight case containing all necessary gearing sprocket wheel, etc. A dial graduated in feet and inches, with pointer, is provided for indicating at all times the amount o water present in a compartment. An alternating current elec tric transmitter for transmitting the indications to the in dicator in the docking master's position is also contained in the same watertight case. Usually, there are a number o indicator transmitters for each pontoon to indicate the wate level in both the port and starboard compartments, the elec tric transmitter of the instrument being connected to the water level indicator.

The water level indicators are mounted on the switchboard at the docking master's position, and are provided with a manually operated pointer so that the predetermined amount of water desired in a compartment can be set, and when the electric pointer, operated by means of the transmitter, matches the manually set pointer, it indicates that the compartment contains the amount of water desired.

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Recent Developments in Marine Insurance

Delay at Japanese Ports—Lake Rates—Imaginary Perils—Over-carriage—Repairs and Seaworthiness—Schooners—Cotton

By "Bordereaux"

DELAY and deviation are problems directly involved in the present deplorable shipping conditions at Yokohama, Tokio and other Japanese ports that suffered most from last September's earthquake. These dual considerations are of prime importance to underwriters, brokers and assureds so far as they affect the coverage granted under the warehouse-to-warehouse clause containing the provision of "ordinary course of transit." Large numbers of shipments made prior to the earthquake, as well as subsequent to it, are still held on docks at Kobe and Yokohama, and the natural question is, are such shipments in the ordinary course of transit to this time? If they are, the underwriters are still liable and are not entitled to additional premium. If they are not "in ordinary course of transit," then the question is, is the delay a deviation which will extend the policy coverage under the deviation clause at an additional premium to be arranged?

There is now, and always has been, more or less doubt as regards the problem of delay and deviation. The Marine Insurance Act of Great Britain, 1906, grants the same excuses for delays as for deviations, and among such excuses is "all delays beyond the control of the master of the vessel or the owner of the goods." If the American law is the same as the British law, the delays at Japanese ports would seem to come under the heading of excusable delays, and the underwriters thus compelled to remain on the risks until arrival at consignee's or other storage warehouse without additional premium. The term "ordinary course of transit" probably could not be invoked to relieve the underwriter, because as long as the goods are in the usual channel of transit they are in ordinary course. The term "ordinary course" does not apply simply to the flux of time.

In many cases, of course, goods have been placed in storage, in which event there can be no question of the termination of the insurance unless special arrangement has been made for the extension of the risk.

The great authority Phillips has this to say of "delay": "Unusual and extraordinary delay in the prosecution of a voyage and prolongation of its period, without necessity or just cause, after the risk has begun, is deviation." He cites cases to show that the mere length of time is not the criterion, but that the necessity and motives and all the circumstances are to be considered.

Mr. Justice Kent, in the case of Suydam v. Marine Insurance Company, 2 John, New York, 138, where the master of the vessel delayed twenty-three days for the purpose of obtaining permission to enter the port Santiago, Cuba, gave this opinion: "The delay cannot be considered as amounting to a deviation, because it does not appear to be unreasonable or willful, but resulted from a probable expectation of permission to enter."

In Parsons, Vol. II, Page I., this observation on "deviation" appears: "The result of this is that, although 'deviation' in the law of insurance originally meant, no doubt, only a departure from the course of the voyage, it is now always understood in the sense of any material departure from, or change in, the risks insured against, without just cause."

To quote once more from Parsons: "And if the goods are insured until safely landed, an unusual and unnecessary delay in discharging them will exonerate the insurers. But the mere lapse of time is no proof of such a deviation. . . . It enters importantly into the question and is, indeed, the basis of it. But the question is, as in all cases of deviation: 'Has there been any voluntary, extraordinary delay, not justified by necessity, or some cause equivalent to necessity?'"

Lake Rates and Conditions

LAKE underwriters held a special meeting on April 4 and decided, in view of the experience of the last several years, to adopt last year's rates and conditions and to leave rates for late sailings and matters of special forms to a special committee.

The Montreal tariff for the coming season has been reduced to such an extent that it is now in many instances, as low as that of New York. This is likely to give much satisfaction to shippers using the Canadian port, as they have long contended that the higher rates have been an unjust discrimination against them. But it will not suit the underwriters. An examination of the relative conditions surrounding the ports of Montreal and New York fails to show any basis for the charge of discrimination at former rates. It has to be borne in mind that Montreal is 580 miles up a river which is subject, in some places, to a rise and fall of tide of twenty-six feet, causing a terrific current. Also that the entire St. Lawrence region is, for long periods of time, covered with heavy fogs that make navigation extremely hazardous. Each year the underwriters are compelled to face serious casualties as a result of these conditions—and yet the rates come down.

Liability of Carrier

GOODS that have been delivered to a carrier are in his custody, even before they have been actually loaded, and he is liable for damage occasioned by failure to use reasonable care in their protection. Such was the decision of the United States District Court at New York in the *Solburg* case (1924 A.M.C.35). It was held that the carrier is at least under the obligations of a warehouseman before loading. In this instance, because he failed to provide waterproof covers for the goods he was held responsible and the shipper recovered damages.

The facts are interesting. Prior to the arrival of the vessel in which the tobacco was to be shipped, several hogsheads of the commodity were delivered to the dock and dock receipts were issued which were subsequently surrendered for bills of lading. When the voyage was completed and the tobacco landed it was discovered to be in a damaged condition from contact with fresh water. It was proved that the tobacco, while on the dock previous to shipment, had been covered only by tarpaulins, and that considerable rain had fallen on some of the days before it was taken aboard.

Imaginary Perils Not Covered

SHIPMASTERS may easily void a contract of insurance by taking action against fancied perils. No recovery is possible for a general average loss unless it can be proved that there was actually a peril, and not that the master of a vessel merely thought so. This important point was recently decided in the King's Bench Division of the English court in the hearing of a suit brought by Watson &

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Son, Ltd., against the Fireman's Fund Insurance Company, 16 Asp. Mar. Law Cs., 93, where recovery was sought for damage to a shipment of rosin in barrels. The shipment was covered by insurance certificates, and the ordinary risks were insured against, including those of fire and explosion. In the course of the voyage the captain thought he saw smoke or steam issuing from the hold where the rosin was, and he at once ordered high pressure steam turned in so as to put out what he thought was a fire. But there had been no fire. The vapor he saw had been caused by the breaking of a steam pipe and the consequent heating of the rosin. The introduction of the steam caused substantial damage.

The plaintiffs contended that this occurrence should be regarded as a general average loss, arguing that it had been incurred for the purpose of avoiding, or in connection with the avoidance of, a peril insured against. The underwriters, on the other hand, insisted that they could not be held liable, as they had insured against fire, not against the consequence of the captain's error of judgment in making his decision as to whether there had been a peril or not. The court held with the defendants, maintaining that there must be an actual peril insured against, not an imaginary one.

Writing Schooners

SCHOONER underwriters have been having a bad time of late. Violent storms on the Atlantic seaboard recently destroyed the three-master *Spindrift,* the large six-master *Wyoming* and the six-master *Ruth E. Merrill.* Nantucket shoals has been the graveyard of these underwriters' hopes. Schooners are now chiefly used in carrying coal, lumber and molasses. The latter commodity comes up from Cuba and Central America and is usually carried directly to Boston. Schooner hulls are classed according to size and trade and are written under what is known as the Boston Schooner form. The rate varies with the age of the vessel. In the case of the *Wyoming,* above referred to, the rate was from 10 to 12 percent.

Over-Carriage and the Strike Clause

ENQUIRY is often made as to the liability of marine underwriters for damage occurring to cargo during over-carriage under a policy excluding the risks of strikes and riots, but containing the deviation clause. The problem was recently illustrated in the return from Bremen to New York of the steamer *President Harding* with a large part of her cargo still undischarged on account of a strike at the German port.

If the policy involved contained a clause covering against over-carriage, or a clause granting all liberties as per contract of affreightment, and the bill of lading gave the United States lines the right, under the circumstances, to over-carry, the underwriters would undoubtedly be liable for loss or damage arising from insured perils during the voyage, subject to additional charge if the policy clause provided therefor. The clause excluding loss or damage by strikers, riots, etc., refers to loss or damage caused by the direct acts of strikers and rioters. If a vessel is delayed due to strike conditions, the underwriters would not be relieved thereby from liability for loss or damage due to insured perils during the delay, but such delay would be considered as a deviation and the underwriter would be entitled to additional premium. If the policy included coverage against strikes, riots, etc., a delay due to strikes would not be a deviation.

If a vessel, after arriving at her port of destination, returns with a portion of her cargo to the port of shipment with the intention of subsequently completing the voyage, as was the case of the *President Harding,* this is not such an abandonment of the insured voyage as to relieve the underwriters, but constitutes a deviation for which the underwriters are entitled to additional premium. It might be argued that dam... occurring on the return trip would not have been sustai... had it not been for the strike, and that therefore the strik... the proximate cause of the loss, but such an argument is... course, fallacious where the direct agency causing the dam... is an insured peril.

Repairs Affect Seaworthiness

THAT repairs intimately affect the question of seaworth... ness was recently held by the Supreme Court of M... sissippi in a suit by the Fireman' Fund Insura... Company v. the Gulf Trans. Company. The case invol... the following: Where a barge which is insured agai... perils of the sea is injured in a storm, and the insura... company attempts to repair the barge instead of paying t... insurance, as alleged, according to the policy contract, a... then through its agent issues a certificate of seaworthiness... the owner who has paid the contractor for repairing the ba... upon the request of the insurance company, and thereaf... the insurance policy is reinstated, and the barge then s... in smooth waters; a suit, first for the amount of repairs p... at the instance of the insurance company, and second u... the reinstated policy for the second disaster, in which a re... ery is allowed for the amount spent in repairs, and den... because the second disaster was not due to a peril of the s... and therefore not covered by the policy of insurance; does n... preclude a second suit for damages because of the inadequ... and insufficiency of the repairs made by the insurance co... pany on the barge.

London Amends Cotton Clauses

THE Institute of London Underwriters has recent... amended its standard T. L. O. (total loss only) clau... on hulls, and the Alexandria cotton tariff clause... American underwriters are especially interested in the la... change as it affects so many large shipments of cotton. W... give the amended English clauses, and it will be noted th... include the risk of country damage, which is seldom co... ered by American underwriters. This risk is also optio... with the English underwriter, but the coverage is general... granted. The usual coverage on cotton in the Americ... market is "3 percent average each bale," plus the risk o... fire after discharge and "while awaiting and during th... process of fumigation, the insurer to be free from any loss o... expense due to the actual process of fumigation."

Follows the wording of the altered London Institu... clauses:

"1. To pay particular average, if amounting to 3 percent... each bale as if separately insured or on the whole, and to pay th... actual loss on pickings without reference to series, and to pay th... cost of making bales merchantable.

"2. Including risk at port of discharge until delivered in... warehouse or to carriers or by rail, land conveyances or canal... mills at port of discharge or in the interior, but risk under th... policy ceases ten days after discharge from ocean steamer or lig... covered.

"3. It is warranted and agreed by the assured that any sh... risk against fire granted therein shall not cover where the assure... or any carrier or other bailee has fire insurances which wo... attach, if this policy had not been issued.

"4. Warranted by the assured free from any liability fo... merchandise in the possession of any carrier or other bailee wh... may be liable for any loss or damage thereto and for merchandis... shipped under a bill of lading containing a stipulation that th... carrier may have the benefit of any insurance thereon, and that... any insurance granted herein shall not cover where any carrier o... other bailee has insurance (whether prior or subsequent in dat... to this policy) which would attach, if this policy had not bee... issued, and that any insurance against fire granted herein shall n... cover where the assured has fire insurance (whether prior or sub... sequent in date to this policy) which would attach, if this polic... had not been issued."

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Tonnage

Q. (1,242).—Please differentiate between the several kinds of tonnage.

A. (1,242).—There are four kinds of tonnage in use. They are deadweight tonnage, cargo tonnage, registry tonnage and displacement tonnage. It is not considered necessary to include in this explanation the rules or methods upon which measurements are based. The rules for the admeasurement of vessels in accordance with the laws of the United States or with the Suez Canal regulations will be found in "Measurement of Vessels," published by the Department of Commerce. Rules for the measurement of vessels for the Panama Canal are contained in the proclamation of the President of the United States, of November 21, 1913.

(*a*) *Deadweight tonnage* expresses the number of tons of 2,240 pounds that a vessel can transport of cargo, stores, bunker fuel, etc. It is the difference between the number of tons of water a vessel displaces when light and the number of tons it displaces when submerged to the deep load mark or to a pre-determined load waterline. Deadweight tonnage is used interchangeably with deadweight carrying capacity. A vessel's capacity for deadweight cargo is less than its total deadweight tonnage by the amount necessary for fuel, stores, etc.

(*b*) *Cargo tonnage* is either "weight" or "measurement." The weight ton used is the long or gross ton of 2,240 pounds. In countries using the metric system a weight ton is 2,204.6 pounds. A "measurement" ton is usually taken to be 40 cubic feet, but in some instances a larger number of cubic feet is taken for a ton. Ocean package freight is usually carried on either a weight or measurement base (W/M) ship's option.

(*c*) *Registry tonnage, gross* represents the total or gross volume within the inclosed portions of a ship's structure (including the structures on deck) with certain exceptions. It is determined by dividing the volume in cubic feet of a vessel's closed-in spaces by 100. A register ton is therefore 100 cubic feet. For purposes of registry a vessel is measured for both gross and net tonnage.

(*c*-1) *Registry tonnage, net* is intended to express the space available for the accommodation of passengers and the stowage of cargo, i. e., the earning capacity of a vessel. It is arrived at by deducting from the gross tonnage spaces occupied by the propelling power, fuel, crew and spaces necessary for operating the vessel. However the deductible spaces and methods of computing them vary considerably under the laws of different countries. A ton of cargo, in most instances, occupies less than 100 cubic feet, hence a vessel's cargo tonnage usually exceeds its net tonnage and may in some instances exceed the gross tonnage.

(*d*) *Displacement* of a vessel is its weight, in tons of 2,240 pounds. Displacement "light" is the weight of the vessel without stores, bunker fuel or cargo. Displacement "loaded" is the weight of the vessel with cargo, bunker fuel and stores on board.

(*e*) *Example.* The following shows the relative tonnage figures for certain cargo vessels:

	Collier (Cæsar)	Cargo Ship (Capella)	Collier (Orion)
Registry tonnage, net	1,595	3,116	6,174
Registry tonnage, gross	2,812	5,078	10,183
Deadweight carrying capacity	4,000	7,500	14,200
Displacement, loaded	5,950	11,450	20,250

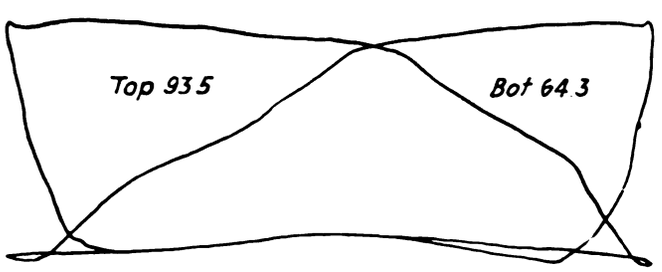
(*f*) *Tonnage for Panama Canal.* For passage through the Panama Canal all vessels except warships must have their gross and net tonnage determined in accordance with prescribed rules. Warships are not measured for gross and net tonnage, but present authenticated displacement scale and curves for obtaining the displacement tonnage at any mean draft. Displacement curves for Panama Canal tolls are furnished by the Bureau. Naval supply, hospital and repair ships, transports, colliers, tenders, etc., are not classed as war vessels.

(*g*) *Tonnage for Suez Canal* is figured under prescribed rules accepted by the several large maritime nations. The measurement is upon a basis of 100 cubic feet per ton. It differs somewhat from the Panama tonnage and is almost invariably in excess of the Register Tonnage. Warships are measured under the same conditions as merchant types and the displacement method is not accepted in any case.

Rectifying Valve Trouble

Q. (1,243).—The indicator card shown in the illustration is from the high pressure engine and I wish to know something about equalizing the work between the ends. I am going to rebore the valve chest and put in new plugs. At present, both top and bottom plugs are the same width and the valve is set with ⅛-inch lap on top and 1/16-inch lead on bottom. The valve is of the piston type; valve gear, Stevenson link, indirect. Any information you can give me that may be of help in rectifying the valve trouble will be appreciated.—D. N. H.

A. (1,243).—The card which accompanies your question shows but one thing for certain and that is that an evening



Indicator Card from High Pressure Engine: Spring, 80; Steam Pressure, 180; Red., 83.4

up of the cut-offs should be made. This may be accomplished by raising the valve on its stem, if steam is taken over the ends, and lowering, if steam is taken at the center. All events are so distorted at half cut-off, especially if the eccen-

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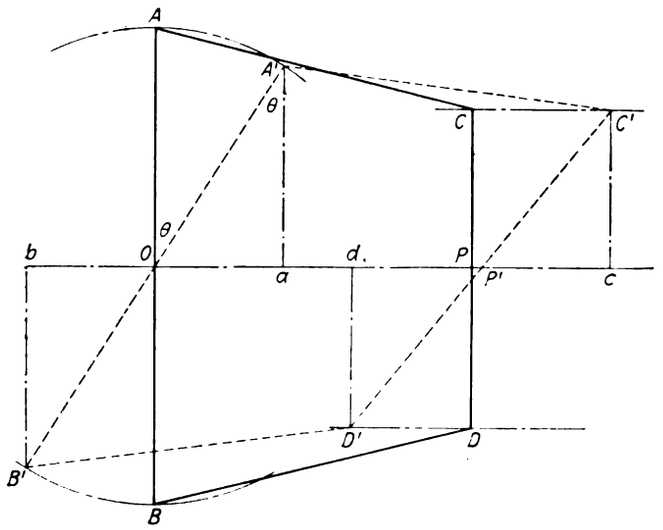
tric rods are crossed, that no comments as to other faults are possible. In order to make a comprehensive study of the problem a card under full ahead conditions would be necessary. Should definite corrective amounts be required, actual dimensions of ports and their distance apart, valve measurements, angle of advance, throw of eccentric and stroke of engine would be necessary.

End Movement of Shaft of Screw Type Steering Gears

Q. (1,246).—Please explain the reason for and give a method of calculating the actual amount of the end movement of the screw-shaft of the standard right-and-left screw type steering gears fitted on naval vessels.

A. (1,246).—The essential features of the mechanism of the right-and-left screw steering gear are shown in the diagrammatic sketch. The transverse scale is greatly exaggerated in order better to show the magnitude, which is very small, of the end movement of the screw-shaft.

The various members contributing to this movement, other than the screw-shaft itself, are shown by full lines for O



Diagrammatic Sketch of Right-and-Left Screw Steering Gear

degrees rudder angle and by dotted lines when the rudder has turned through Θ degrees. Then in the two respective positions, the rudder crosshead is represented by AOB and A'OB'; the links, or connecting rods, by AC, BD, A'C', B'D'; and the centers of the pins connecting the links and driving nuts by C, D, C', D'. The line bc is the axis of the screw-shaft and its prolongation, AA' and BB' are the arcs in which the crosshead pins move while CC' and DD' are the changes in position of the driving nuts, CC' and DD' being parallel.

If CC' and DD' were of equal length, the line C'D' would pass through P; since the intersection of C'D' with the axis of the screw-shaft is at P' the shaft and driving nuts have been given a motion of translation equal to PP'.

The reason for this end motion lies in the fact that the links or connecting rods are not parallel, one end of each travels in a circle while the other moves parallel to the axis of the screw-shaft and to each other.

The amount of this motion varies with the dimensions of the gear. It may be found from the following:

Let r = radius of the rudder crosshead.
s = distance of driving nut pins from axis of screw-shaft.
L = length of link or connecting rods.
Θ = rudder angle.

A'a, B'b, C'c, and D'd are perpendiculars drawn to bc.

$CC' = ac - aP = ac - (OP - Oa)$ (1)

But C'c=CP=DP=D'd=s and OA = OA' = OB = OB' = r

Also $A'a = r\cos\theta$; $Oa = r\sin\theta$.

$ac = \sqrt{L^2 - (r\cos\theta - s)^2}$; $OP = \sqrt{L^2 - (r - s)^2}$

Making these substitutions in (1)

$CC' = \sqrt{L^2 - (r\cos\theta - s)^2} - \sqrt{L^2 - (r - s)^2} + r\sin\theta$

$DD' = bP - bd = bO + OP - bd$

But bO = r sinΘ and bd = ac

Substituting the values of bO, OP, and bd in

$DD' = r\sin\theta + \sqrt{L^2 - (r - s)^2} - \sqrt{L^2 - (r\cos\theta - s)^2}$

Now $PP_1 = \frac{1}{2}(CC' - DD')$ and subtracting (2a) from (2) gives

$PP' = \sqrt{L^2 - (r\cos\theta - s)^2} - \sqrt{L^2 - (r - s)^2}$ (3)

This formula is general in its application since, whether (r — s) or (r cosΘ — s) is positive or negative, the square of each expression is positive and therefore equally applicable whether r is greater than, equal to, or less than s. A numerically negative value of PP' has no significance except that the movement of the screw-shaft is in the opposite direction to that for a positive value.

An analysis of equation (3) shows that if r = s, then PP' increases with Θ and is negative, *i. e.*, the motion is toward O. If (r cosΘ — s) is greater than s, PP' is negative but if less, then PP' is positive.

Assuming r = 36 inches.
s = 24 inches.
L = 120 inches.
Θ = 38 degrees, cos 38° = .78801.

Then $PP' = \sqrt{(120)^2 - (36\cos 38° - 24)^2} - \sqrt{(120)^2 - (36-24)^2}$

or, PP' = 0.522 inch.

This result is larger than that usually found in practice on account of the large difference in the assumed values of r and s. If r, s, and Θ had been assumed as 18 inches, 24 inches and 35 degrees, PP' would be — .198 inch.

Method of Computing Amount of Coal Removed from Barge

Q. (1,256).—Please give a practical rule for computing the amount of coal removed from a rectangular barge, based on displacement; for example, a coal barge when loaded measured on:

Forward starboard corner, 6 feet from deck to waterline.
Forward port corner, 5 feet 6 inches from deck to waterline.
After starboard corner, 6 feet 6 inches from deck to waterline.
After port corner, 6 feet from deck to waterline.

After removing part of coal from barge the following measurements were taken:

Forward starboard corner, 10 feet from deck to waterline.
Forward port corner, 9 feet 6 inches from deck to waterline.
After starboard corner, 4 feet from deck to waterline.
After port corner, 4 feet 6 inches from deck to waterline.

The dimensions of the coal barge were as follows:

90 feet long by 40 feet wide by 20 feet deep from deck to bottom of cargo hole. How much coal had been removed from the barge?

A. (1,256).—The difference between the displacements of the barge before and after the removal of the coal is the weight of the coal removed.

The difference in the mean draft or mean freeboard of the barge in feet multiplied by the area of the water plane of the barge in square feet is the difference in displacement expressed in cubic feet. This difference multiplied by the weight in pounds of a cubic foot of the water (62.4, if fresh and 64, if salt) will give the difference or change in displacement in pounds, *i.e.*, the weight in pounds of the coal removed.

The numerical solution of your problem is as follows:

	Original Condition	After Removal of Coal
Mean freeboard forward	5 feet 9 inches	9 feet 9 inches
Mean freeboard aft	6 feet 3 inches	4 feet 3 inches
Mean freeboard of barge	6 feet	7 feet

Change in mean freeboard due to removal of coal = 1 foot.

Area of water plane of barge is 90 x 40 = 3,600 square feet.

Change in displacement in cubic feet = 3,600 x 1 = 3,600 cubic feet.

Change in displacement in pounds (fresh water) = 3,600 x 62.4 = 224,640.

Change in displacement in pounds (salt water) = 3,600 x 64 = 230,400.

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NEW BOOKS

ENGINE ROOM PRACTICE. By John G. Liversidge, R. N. Size, 5 by 7½ inches. Pages, 429. Illustrations, 132. Plates, 13. Philadelphia, 1923: J. B. Lippincott Company.

In this, the eleventh edition of Admiral Liversidge's well known work, a thorough revision has been carried out and much new material, made necessary by developments since the last edition was published, has been included.

One might wish that a little more space had been devoted to oil fuel and turbines, but the book is filled with useful information, little of which could afford to be omitted and it seems essential that a book of this character should be made as compact and handy as possible.

The printing and illustrations are both excellent and taken altogether the book is a most convenient and useful one for all marine engineers.

THE MERCHANT MARINE. By Rear Admiral William S. Benson, U. S. N. Size, 5¾ by 8½ inches. Pages, 183. New York, 1923: The Macmillan Company.

No one is better fitted, by way of professional experience and personal interest in the subject, to write of the American merchant marine, than Admiral Benson. In the book which he has written at the request, we understand, of the Knights of Columbus, there is crowded a great amount of information which is presented in an attractive and very readable way.

Admiral Benson's long naval experience has made clear to him the great importance of the merchant marine as a means of national defense. Never has this function of our commercial vessels been of such outstanding importance as it is today, and this fact is most clearly and forcibly stated.

While the book is largely taken up with a discussion of present conditions and problems, the history of mercantile shipping as given, in outline, from its earliest beginnings and the development of ships' types and of steam navigation are touched upon, as well as other pertinent matters.

For the dispersion of a knowledge of the merchant marine among those who, in ordinary course, would remain ignorant of it, the book is excellently devised and its publication most timely.

PERSONAL MENTION

A. F. ZIPF has been appointed Pacific coast manager of the William Steamship Line.

F. H. HAYWARD has been appointed manager of the new Portland, Ore., office of Struthers & Barry.

DANIEL G. COOK is now assistant Pacific coast manager of the Williams Line, succeeding Richard Prosser.

JOHN W. CHAPMAN, formerly Pacific coast manager for the William Steamship Line, has been appointed San Francisco agent for the Alaska Steamship Company.

GEORGE E. MONROE, formerly estimator at the Tebo Yacht Basin plant of the Todd Shipyards Corporation, has been appointed assistant superintendent of Theo. Crane & Sons.

J. H. HALL, former chief steward of the steamship *City of Los Angeles*, has been appointed port steward for the Los Angeles Steamship Company, succeeding Harvey Rothschild, resigned.

H. A. HAVERFIELD has been appointed superintending engineer of the Mallory Transport Lines and C. D. Mallory & Company. He recently resigned his connection with Charles Cory & Son.

RALPH E. DEVINNEY, formerly connected with the Atlantic Gulf & Pacific Steamship Company and the Luckenbach Lines, has been appointed Oakland manager for the Lawrence Warehouse Company.

C. F. MACDONALD, formerly of Lloyd's Register of Shipping, New York, has been elected a director of the Pennsylvania Shipyards, Inc., Beaumont, Texas, with the title of vice-president and general manager.

E. L. SHEEHAN, recently appointed general passenger agent of the Canadian Pacific Railway Company and Canadian Pacific Steamship services at Seattle, Wash., has been transferred to Hongkong as acting general passenger agent in the Orient.

FOSTER L. HAWKINS, New York representative of the New York Harbor Dry Dock Corporation at 32 Pearl street, left that corporation on April 15 to become the general manager of the Port Jefferson Marine Railway Corporation, Port Jefferson, L. I. Mr. Hawkins has been with the New York Harbor yard for the past three years, after serving three years with the American Bureau of Shipping. Prior to this time he went through various marine apprenticeships and later owned the controlling interest in two small shipyards. The Port Jefferson Marine Railway Corporation is equipped to build, repair and dock steel and wooden vessels up to 2,200 tons and its present reorganization was consummated by the Bridgeport & Port Jefferson Steamboat Company.

Foster L. Hawkins

WILLIAM D. BECKER was elected president of the Becker Steamship Company, Cleveland, Ohio, on March 31. At the same meeting James B. Walsh was elected vice-president and treasurer; C. L. Ayers, secretary, and Lottie E. Ailes, assistant treasurer.

GEORGE T. WASHBURNE, formerly associated with the W. & A. Fletcher Company as its general superintendent, has joined the organization of New York Harbor Dry Dock Company, Inc., as general superintendent of its main plant at Clifton, Staten Island.

J. L. ACKERSON, former president of the Atlantic Coast Shipbuilders' Association, has been reappointed by President Charles P. Vaughn of the Philadelphia Chamber of Commerce as a member of the Industrial Relations Committee of that organization.

RICHARD F. SHERIDAN and C. F. Tait have organized the Crown Terminal Company with offices at 149 California street, San Francisco, and will handle the Furness Line at San Francisco. R. A. Satterwaite is in charge of the Crown Terminal Company's dock operations.

WILMER M. WOOD, agent for the American-Hawaiian Line at Philadelphia, has announced several changes in the executive staff of the company, as follows: J. G. Jones, formerly traffic department executive, has been promoted to assistant agent; W. C. Shannon, recently with the Ocean Traffic Bureau, succeeds Mr. Jones in the traffic department; C. W. Trowbridge has joined the soliciting staff, and Eugene Tyrell, long associated with the American-Hawaiian's affairs, has resigned.

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CAPTAIN J. M. PATTON has been appointed district agent for the Shipping Board to succeed C. S. Nye, who has been transferred to Savannah. Captain Patton was formerly marine superintendent of the Emergency Fleet Corporation and is president of the Pennsylvania School Association and a graduate of the Schoolship *Saratoga*.

COMMANDER STEVENSON TAYLOR, president of the American Bureau of Shipping, will be decorated with the Conspicuous Service Cross, awarded by the New York State legislature. The award will be made by Col. John J. Phelan, commanding the 165th Infantry, and will take place on May 14 at that regiment's armory, in New York City.

CHARLES A. G. ARMSTRONG and GUNNAR C. ENGSTRAND, for many years associated with William T. Donnelly, consulting engineer, 17 Battery Place, New York, have opened offices at 26 Water Street, New York City, as naval architects, marine and consulting engineers. Both members of the new firm have been engaged for over twenty years in general engineering work, specializing in the design, construction and operation of floating dry docks and ship repair plants in New York, Boston, Philadelphia, Baltimore, Mobile, New Orleans, Galveston and Prince Rupert, B. C. During the past twelve years Mr. Armstrong has given special attention to the above class of work and for the past fifteen years Mr. Engstrand has had charge of design work for William T. Donnelly, specializing in pier work, reinforced concrete, steel construction and timber work, including the design of buildings and several floating dry docks. Since January, 1922, Messrs. Armstrong and Engstrand have been consulting engineers for the H. J. Wheeler Salvage Company, assisting in the development of their oil sludge removal system. Mr. Engstrand is also bringing out a new design of floating dry dock constructed with steel sides and wooden pontoons in which the pontoons are of trapezoidal instead of the usual rectangular cross section, resulting, it is claimed, in a marked reduction in the cost of construction and increased stability and ease of handling of the dock.

C. A. G. Armstrong

G. C. Engstrand

T. B. NOLAN of Chicago was recently elected general secretary of the Sailors' Union of the Great Lakes; Val Duster, also of Chicago, was made general treasurer. The Milwaukee agent is now Charles Bradherring; the Detroit agent, William Donnelley; the Cleveland agent, E. J. Sullivan, and the Buffalo agent, Patrick O'Brien.

GEORGE R. LOWE has been appointed traveling passenger agent for the Admiral Oriental Line in the middle western states with headquarters at Chicago according to an announcement made by Dean J. Hanscom, general passenger agent for the Line. Mr. Lowe was formerly general agent for the Admiral Oriental Line at Yokohama and has recently been stationed at Chicago in the offices of the Admiral Oriental and Dollar Steamship Company.

LIEUTENANT-COMMANDER H. H. NORTON, U. S. N., for the past few years in charge of the fuel oil testing plant at the League Island Navy Yard, Philadelphia, Pa., and also head of the fuel oil school for merchant marine officers conducted at that plant by the United States Shipping Board has been detached and ordered to the Asiatic station. Lieutenant-Commander Donald, U. S. N., has been ordered to the fuel oil testing plant and will continue to train marine engineers at this school.

CAPTAIN ROBERT DOLLAR of New York and San Francisco, president of the Dollar Steamship Company, has been elected a member of the executive committee of the American Steamship Owners' Association to succeed P. A. S. Franklin of New York, president of the International Mercantile Marine Company, who resigned early this year. Captain Dollar is the president of the Pacific-American Steamship Association.

CAREY W. COOK was elected president of the American-Hawaiian Steamship Company on March 20 at the annual meeting held for the purpose of naming the future officers of the company. Henry Dearborn of Seattle was made first vice-president, and J. D. Tomlinson, second vice-president. The directors named were Carey W. Cook, W. A. Harriman, W. D. Clark, John Rosenfeld, R. D. Lapham, Henry Dearborn, L. G. Hengstler and J. D. Tomlinson.

CAPTAIN EUGENE HAYWARD, for the last seven years master of the flagship *City of Detroit III* of the Detroit & Cleveland Navigation Company, Detroit, Mich., has received the title of "admiral of the fleet" according to a recent announcement by A. A. Schantz, president and general manager of the company. It is expected that Admiral Hayward will transfer his flag to the new steamer *Greater Detroit* when she is put into commission on the route between Detroit and Buffalo this summer. Admiral Hayward has been with the company for 27 years, serving continuously for the last 22 years.

OBITUARY

J. LEONARD MOORE, inventor of the Moore turbine, was found dead on April 3 in his home in Wellsville, N. Y.

CAPTAIN ANDREW J. KELLEY, aged 75, former well-known Great Lakes captain and for several years dockmaster at the foot of Ferry street, Buffalo, was found dead in his office April 4.

SAMUEL M. KNOX, former president of the New York Shipbuilding Corporation, Camden, N. J., died suddenly of heart disease at Wilmington, Del., on April 8, aged 66. Mr. Knox became identified with the New York Shipbuilding Company in 1903 as its secretary. Later he was elected treasurer and in the early years of the war, when torpedo warfare had greatly increased the demands on his company, he was elected president. In 1915, Mr. Knox sailed for England in the company's interests on the ill-fated *Lusitania* and miraculously escaped with his life when the vessel was torpedoed and sunk. In 1917 when the company was reorganized and enlarged to meet the country's wartime demand for ships, Mr. Knox resigned as president and became a member of the board of directors.

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ELLIOTT STONE, connected with the traffic department of the Luckenbach Steamship Company, and for many years well known in New York shipping circles, died April 7 at Yonkers, N. Y.

CAPTAIN JAMES W. STERLING, commander of the lighthouse tender *Hibiscus* since 1908, died in Portland, Me., March 30. Captain Sterling had been connected with the Lighthouse Service for 45 years.

FRANK A. FISH, retired assistant superintendent of river steamers for the Southern Pacific Company, died on March 19 at his home in Benicia, Cal. Mr. Fish began service with the Southern Pacific Line in 1876 and retired from active service in 1921.

CAPTAIN JAMES G. BALLINGER, U. S. Coast Guard, retired, died on April 3 of heart trouble at his home at Jackson Heights, New York. He was formerly commander of the revenue cutter *Bear* and well known in all American ports. Captain Ballinger, who was 57 years of age at the time of his death, was born in Illinois and graduated from the Naval Academy at Annapolis in 1888.

DR. WILHELM SCHMIDT, famed for his pioneer work relating to the art of steam superheating, died on February 16 at Bethel, near Bielefeldt, Germany, at the age of 66. Dr. Schmidt started his career as a locksmith and through coincidences his natural ability to speculate correctly on matters of physics and engineering came to the attention of prominent men who made it possible for him to educate himself and carry through the realization of his ideas. Schmidt, who in early years recognized the great importance of the superheating of steam for the economy of steam engines, spent the larger part of his life in fighting the prejudices that made learned engineers opposed to this practice and to build up an organization which was finally able to overcome these prejudices and carry his ideas to commercial success. His best known accomplishment was the creation of a practical locomotive superheater, but he also did much towards the practical superheating of steamships and stationary power plants. In the last ten years of his life he spent much effort and vast sums of money on the demonstration of practical ways and means to combine the thermal advantages of high superheat with the thermal advantages of relatively high steam pressures, which he termed "super-pressures."

Dr. Wilhelm Schmidt

S. B. BOYD, formerly assistant chief draftsman at the Boston Navy Yard, died at his home in Lexington, Mass., on April 20. Mr. Boyd received his first training in engineering at the Massachusetts Institute of Technology and for many years was employed in the construction and repair department at the navy yard. He was a nephew of the late James T. Boyd, the chief engineer of the Atlantic Works in East Boston.

DE COURCEY MAY, for many years president of the New York Shipbuilding Company, Camden, N. J., died in Baltimore, Md., on March 23. Although he had been retired from active business since before the war, his loss will be deeply felt by the engineering profession. Mr. May, who was a member of one of the most prominent Maryland families, was born in Baltimore over seventy years ago. He was educated abroad and after leaving school served an apprenticeship in engineering and shipbuilding with a firm in Leith, Scotland. Later he was employed for some time by John Elder & Company, now the Fairfield Shipbuilding Company, and eventually returning to this country, attained distinction in the design of large steam engines and other heavy machinery. Among the engineers with whom he was at one time or another intimately associated may be mentioned E. D. Leavitt, the eminent mechanical engineer; the J. P. Morris Company and the Dixon Manufacturing Company of Scranton, Pa., which latter company he served as general manager. Coming to the New York Shipbuilding Company as general manager, in 1901, Mr. May succeeded to the presidency of the company upon the death, in 1903, of its founder, the late Henry G. Morse, and continued in this position until his retirement from active business about twelve years ago. Aside from his great fund of engineering knowledge, Mr. May had an inborn faculty for handling the complicated details involved in the management of a great industrial plant, and a most unusual personal charm which won for him the instant liking and support of all with whom he came in contact.

JOHN H. DIALOGUE, for the past nine years consulting engineer with the Luckenbach Steamship Company, died at his home in Brooklyn, N. Y., on April 19. With the passing of Mr. Dialogue the shipbuilding profession of this country has lost one of its best known members. Born in Camden, N. J., fifty-nine years ago, Mr. Dialogue, at an early age, entered his father's shipyard at Kaign's Point, Camden, N. J., and learned the business of iron shipbuilding "from the ground up." After serving an apprenticeship in practically every department of the yard, he became his father's partner, the firm name being John H. Dialogue & Son, and thus continuing for many years. The Dialogue yard, although of comparatively small size, was complete in its equipment and built the boilers and engines as well as the hulls of all of its contracts. No firm in the country excelled it in the production of towboats of all sizes and "Built at Dialogue's" was long a hall mark for this class of vessel. While the firm confined itself mainly to the building of towboats, vessels of other types were occasionally turned out, the largest being the steamship *Louis Luckenbach*, of 3,905 gross tons, which was launched in 1903. The U. S. gunboat *Princeton* was also built by this firm in 1895. After his father's death, Mr. Dialogue carried on the business for a long period, but eventually gave it up and the yard was sold to the Philadelphia & Reading Railroad to be used in the extension of its Camden terminal. For the past nine years, Mr. Dialogue has been employed by the Luckenbach Steamship Company as its consulting engineer, a position for which his wide experience and intimate knowledge of the technical as well as the practical side of shipbuilding and marine engineering peculiarly fitted him. To his many friends in shipping and shipbuilding circles, Mr. Dialogue's death has brought a sincere and deep feeling of regret and to the profession of which he was so long a member it comes as a most unexpected and very distinct loss.

John A. Dialogue

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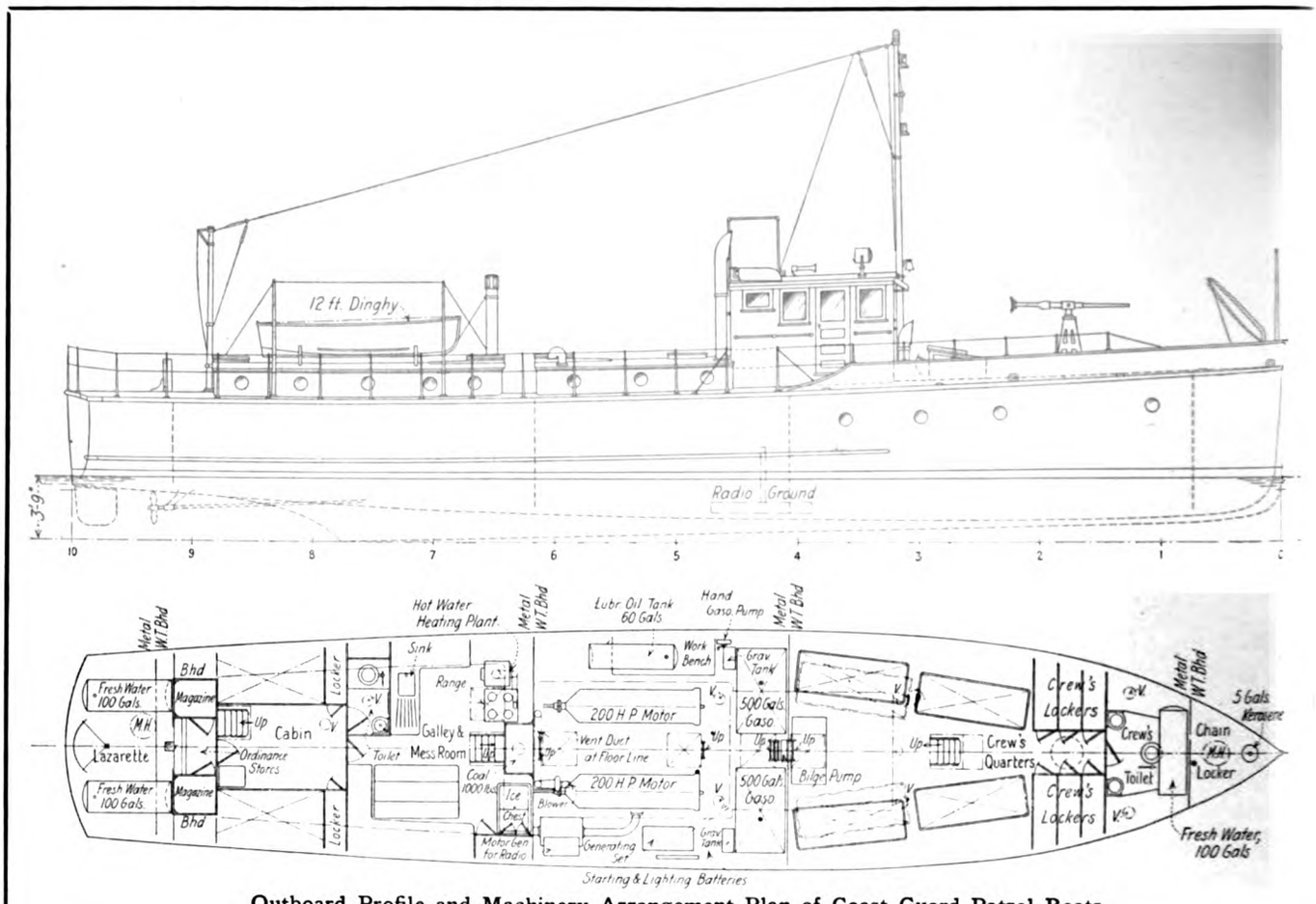
The Month's Shipping and Shipbuilding News in Brie

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries



Outboard Profile and Machinery Arrangement Plan of Coast Guard Patrol Boats

S. S. Maracaibo to Be Converted from Coal to Oil Burning

PLANS and specifications are expected to be issued shortly for the conversion of the steamship *Maracaibo*, of the Red "D" Line, from a coal to an oil burner. Incidental work, covering voyage repairs and inspection requirements, will also be carried out, and it is understood the total amount involved will be close to $50,000.

Annual Meeting of Shipbuilders to Be Held on May 15

Announcement has been made that the seventh annual meeting of the Atlantic Coast Shipbuilders' Association will be held in Philadelphia on Monday, May 12, 1924. A reception is to be held during the afternoon at the offices of the association, 1600 Walnut street, and an informal dinner will be given in the evening at the Bellevue-Stratford Hotel.

Bids Open May 19 for 175 Patrol Boats; Coast Guard Awards Contracts Totaling Over Two Million Dollars

SEALED proposals will be received at the United States Coast Guard Headquarters, 14th and E Streets, Washington, D. C., until 2 P. M., May 19, for the building of one hundred seventy-five 75-foot patrol boats. Tenders will be received from each bidder for building ten, fifteen, twenty-five, thirty-five or fifty boats of the entire number to be built.

Each boat will have an overall length of 75 feet, beam on deck 13 feet 6 inches, beam at waterline 12 feet 6 inches, draft 3 feet 9 inches. Propulsion will be by two 200-horsepower engines, each developing about 1,200 revolutions per minute, the propelling machinery and one-pound gun and mount to be furnished by the government. The equipment of each boat will include one 12-foot clinker-built small boat, two anchors weighing 100 and 200 pounds, respectively, 100 fathoms of ½-inch galvanized chain with shackles, the windlass to be double-acting hand-operated, with one wildcat.

Three 100-gallon galvanized fresh water tanks will be fitted in each boat, the vessel to be heated by an open hot water system, the boiler to be of the radiator-boiler type.

Contracts Awarded

Since the taking of bids for the construction of a fleet of small boats, the Coast Guard has awarded contracts to date, totaling $2,022,665, including the following: 35 Sterling engines (200 horsepower each), at a price of $4,129.30 per engine; 150 Speedway (180 horsepower), at $3,080 each, and for the construction of 36-foot speed boats as follows: Portsmouth Navy Yard, two boats at $3,855 each; Burger Boat Company, Manitowoc, Wis., five boats at $4,100 each; Chance Marine Construction Company, Eastport, Md., five boats at $4,190 each; Frederi

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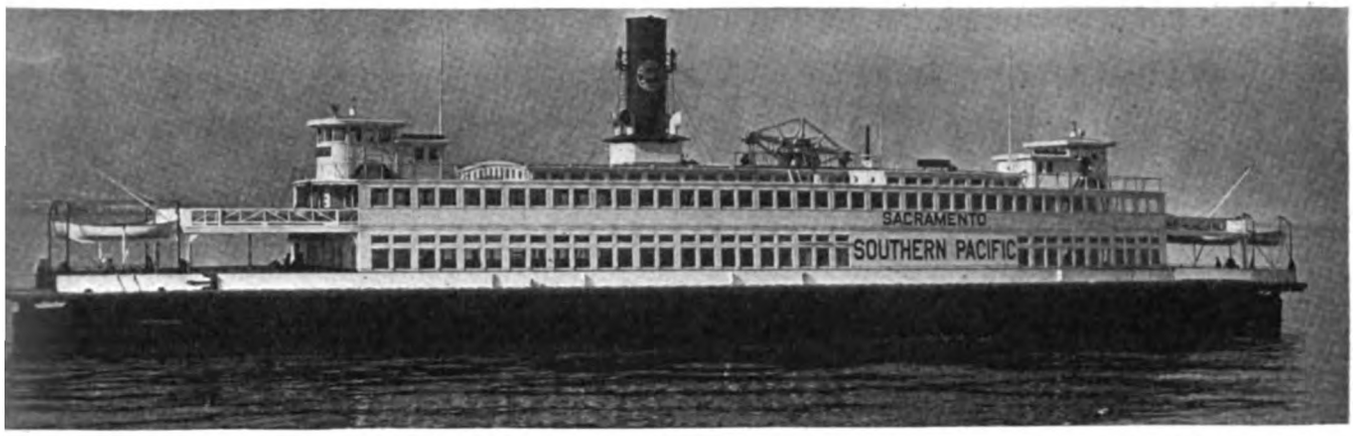

Largest Passenger Ferryboat in the World, Built by the Southern Pac'fic Company for the San Francisco-Oakland Run

Dock, East Greenwich, R. I., five boats at 00 each; Greenport Basin & Construction npany, Greenport, N. Y., five boats at 50 each, and the Gibbs Gas Engine Comy, Jacksonville, Fla., five boats at $4,700 n.

letcher Yards to Continue in Operation

Although Judge Runyon, in the District urt in Plainfield, N. J., last Saturday, ointed Andrew Fletcher, Jr., and John Enright, receivers for the W. & A. tcher Company, of Hoboken, N. J., it is ounced that the company will continue vities in its shipbuilding and repair work oth the Hoboken and Brooklyn plants.

Mr. Fletcher stated that the situation is a ult of litigation brought by British underters as a result of fire on the steamship *Louis*, in 1919, the underwriters seeking collect over $2,000,000 as a result of the s.

New Dipper Dredge Planned By Engineer Office, Washington

ACCORDING to information obtained by MARINE ENGINEERING AND SHIPPING AGE, the office of the Chief of Engineers, Washington, D. C., is preparing plans and specifications for a steel-hull dipper dredge for the U. S. Engineer Office, Nashville, Tenn. The dredge is to be 36 feet by 120 feet and will cost, with machinery, etc., over $100,000.

Derrick Boat and Barges Planned

Arkansas Gravel & Sand Company, Arkansas City, Ark., is considering the construction of a derrick boat.

The Thane Lumber Company, of the same city, plans to construct a new derrick boat to cost $12,500, and two barges, approximately $10,000 each.

Southern Pacific Ferry Sacramento Goes Into Service

THE *Sacramento*, said to be the largest passenger ferryboat in the world, has been placed on the San Francisco-Oakland run by the Southern Pacific Company, which built the vessel at its West Oakland shipyard under the supervision of Charles Green, marine engineer.

The *Sacramento* is 300 feet long and 78 feet beam and has a displacement of 1,590 tons. Seats are provided for 1,950 passengers and over 4,000 life preservers are carried.

PROPELLING MACHINERY

Propulsion is by side paddle wheels 29 feet in diameter with a 10-foot face driven by a vertical beam engine. Steam is supplied by two boilers, each 29 feet long and 10 feet in diameter.

Six and a Half Million in New Vessel Construction Contracts Awarded

CONTRACTS for new vessel construction, reaching an approximate total value of $6,477,322, were announced during the first two weeks of April by MARINE ENGINEERING AND SHIPPING AGE. The construction of three ocean-going ships, two for the Clyde Line and one for the Southern Pacific Company are included in these award figures. The contract for the construction of two passenger and freight ships, each having a length of 402 feet, driven by turbine engines and accommodating between three and four hundred passengers, has been awarded the Newport News Shipbuilding Company, the contract having been signed on April 9. These vessels are for the Cherokee-Seminole Steamship Corporation, a subsidiary of the Clyde Line, and will be used in the run between New York and Southern ports. They were designed by Theodore E. Ferris, naval architect and marine engineer. A description and outboard profile of these steamers were published in our last issue, following original announcements early in 1923.

Final documents are in the course of signature for awarding the contract for the building of a 433-foot freight ship by the Federal Shipbuilding Company for the Southern Pacific Company. The ship is from the design of A. S. Hebble, superintending engineer, and will be driven by turbine engines. Details regarding this vessel were carried in these columns in our March issue. It is understood that the expenditure involved will be approximately $1,500,000.

Other recent new work awarded includes the building of a new passenger steamer for the Norfolk & Washington Steamboat Company by the Pusey & Jones Shipyard at an estimated cost of $800,000; three steel dump scows for the Panama Canal by the Newport News Shipbuilding & Drydock Company on a bid of $300,000; hull construction contract for a 30-inch Diesel electric hydraulic pipe line dredge for the Port of Portland, Ore., by the Wallace Equipment Company, of Seattle, Wash., $158,000, and the building of a twin screw Diesel oil barge for the Associated Oil Company by the Moore Drydock Company, Oakland, Calif., at $119,322. Additional details regarding these vessels were announced in previous issues of this journal.

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Millions to Be Spent for Port, Pier and Equipment Projects on the San Francisco Waterfront

THE expenditure of several millions of dollars is involved in the proposed improvements on the San Francisco waterfront which will take several years for completion, according to official information obtained by MARINE ENGINEERING AND SHIPPING AGE. The Board of State Harbor Commissioners, of which Charles H. Spear is president, Ferry Building, San Francisco, Calif., has under consideration at present, extensive improvements for China Basin and India Basin.

IMPROVEMENTS FOR CHINA BASIN

The China Basin improvement includes the construction of three piers in the space just south of Channel Street in the vicinity of Mission Rock. Each of the piers will be approximately 1,200 feet long, 385 feet wide, with an open dock between each pier of approximately 300 feet in width. The piers will be reinforced concrete deck supported by concrete protected green piles. In deep water, reinforced concrete piles will be used instead of concrete protected green piles. The deck carrying the railroad tracks along the edge of the piers will be of creosoted timber on creosoted piles.

Four 1-story sheds, approximately 590 feet by 115 feet, will make up the superstructure of the pier and each pier will have seven railroad tracks, two down each side and three down the middle.

EQUIPMENT

The China Basin Terminal warehouse, foundations for which are already complete, will be a reinforced concrete structure, six stories high, 134 feet by 810 feet on the first floor and 100 feet by 810 feet above the first floor. The warehouse can be served both by ships and railroads and will be equipped with elevators, cranes, loading platforms, spiral chutes, incinerators, etc., with an inclined driveway to take auto trucks to the second floor.

INDIA BASIN

The improvements proposed for India Basin provide for the reclamation of tide lands between Islais Creek and Hunters Point. This will make approximately 160 acres available for industrial purposes and add six or eight large piers to the facilities of the San Francisco waterfront.

Subsidy for New French Liners Awaits Action of the Senate

By Our Paris Correspondent

I ALLUDED in preceding issues to the order to be placed by the Compagnie Generale Transatlantique for the construction of two new liners for the mail line between Havre and New York. I pointed out that the company was unable to place the long expected order for the first of these two liners until government aid was assured.

In spite of a strong opposition led by some socialist deputies, the bill providing this aid has finally been adopted by the Chamber of Deputies. It provides that the annual subvention granted by the State to the Compagnie Generale Transatlantique shall be increased from 2,500,000 francs to 4 million (minimum) and from 7,200,000 francs to 21,600,000 francs (maximum). This company is also receiving another subvention for the services with Central America. In addition to the direct subsidy the bill in question also provides that the Government shall give its guarantee in respect to the interest on the loans which are to be raised by the C. G. T. for the construction of the two new liners.

Now that the Chamber of Deputies has approved the bill, the only reason for delay is the necessity of final ratification by the Senate. It is hoped that this will take place very shortly, in any case, before the end of the legislative session, which comes in April. It is therefore expected that the C. G. T. will be in a position to place the order for the first of the two liners very shortly.

THREE YARDS TO BID ON FIRST SHIP

It will be recalled that three French shipyards have been invited to tender for the construction of that ship, viz. the Forges et Chantiers de la Mediterranee, the Chantiers et Ateliers de la Gironde, and the Chantier et Ateliers de Saint-Nazaire-Penhoet. It is generally believed that the order will go to the latter firm, which built the *France* and the *Paris*.

The leading particulars of the ship have been given in a former issue. The principal question now under discussion is the choice of the type of propelling machinery. The adoption of Diesel engines has been considered by the owners, but it is very likely that the risk involved by the construction of such a large set of oil engines (about 48,000 horsepower), as well as the additional cost involved will lead the owners to adopt Parsons turbines.

PROGRESS OF SHIPBUILDING

As regards shipbuilding developments, some events of interest have taken place in this country in the course of the last few weeks. The Ateliers et Chantiers de la Loire have delivered to the Messageries Maritimes the second of the three vessels which they were completing for the Indo-China line. This is the *Compiegne*, 10,802 tons gross, 499 feet long, 7,000 horsepower (geared turbines). The first vessel, the *Chantilly*, was delivered some weeks ago; the third one, the *Fontainebleau* will be completed shortly.

There was also launched on March 16 from the yards of the Societe Provencale de Constructions Navales, Marseilles, the passenger steamer *Champollion*, built to the account of the Messageries Maritimes (15,100 tons displacement, 512 feet long. Two triple expansion engines, 4,500 h power.) This vessel is to be placed service on the Egypt line.

A feature of the shipbuilding positio this country is the prevailing shorta orders for new vessels placed by Fr firms. It is fortunate for the shipyard they have succeeded in obtaining some portant contracts from foreign firms, as ported in the last issue, but the steady of the franc is causing them some anxie they can hardly compete with foreign if the pound is worth less than abou francs.

Dipper Dredge Towed Across the Atlanti

THE 8-yard dipper dredge *Lu* designed by A. W. Robinson, consul engineer, Upper Melbourne, Inc built by Lobnitz & Company, Ltd., Ren Scotland, for the harbor of Nassau, Ba Islands, has recently arrived at her des tion under tow of the powerful Dutch *Scheldt*. This is the first time a dr dredge has been towed across the Atl and it was done with the spuds up the b on and all the machinery in place except dipper and dipper arm.

This dredge was fully completed and t under steam on the Clyde, and then m ready for sea. The spuds are of stee inches square and 55 feet high. The s and boom were securely lashed in p against surging. The hull and deckh being of steel, were made watertight ev where so that no water was shipped.

The dredge left the Clyde on Septe 15, 1923, and arrived at Nassau on Jan 5, 1924, after many delays by storms having suffered no damage whatever and maining perfectly tight and dry.

Stops were made at Brest, Vigo, Fun St. Vincent and St. Thomas for coaling waiting for weather. It will be seen the hardy and wary Dutch navigator did try to cross direct by the shortest r which would have led him within a distance of the Newfoundland coast an the track of rough weather. The sh distance from the Clyde to Nassau is a 3,600 miles. Instead he crept along the c of France and Spain into the southern tudes before making the jump across, co ing in all about 6,000 miles.

The tug carried coal for 35 days' steam and additional supplies were carried in b on the deck of the dredge, and transferred boat as opportunity offered.

After delivering his charge safely Nassau, the captain left for New York take home a dead steamship for breaking purposes, all in the day's work.

Such a voyage is a tribute alike to careful preparedness of the builders an the skill and staying powers of the capt and crew.

Dipper Dredge Lucayan Entering Nassau Harbor, Bahama Islands

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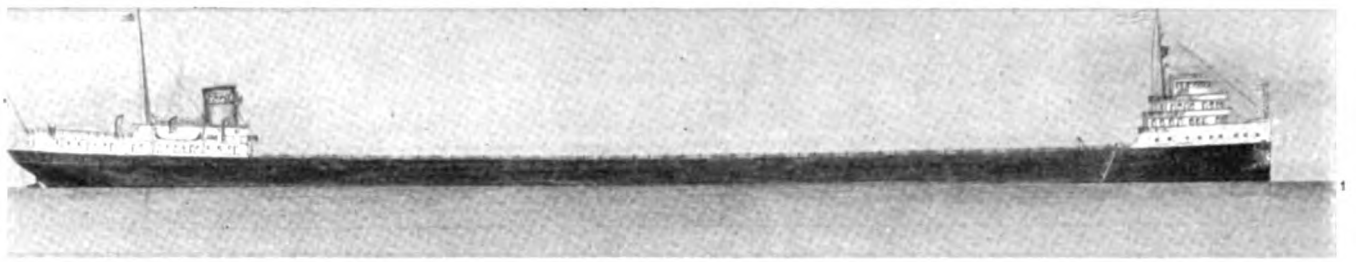

Sketch Showing How the 600-Foot Motorship Henry Ford II, Which the American Shipbuilding Company Is Building at Its Lorain, O., Yard for the Ford Motor Company, Detroit, Mich., Will Look When Completed.

World Shipbuilding Shows Slight Gain

WORLD shipbuilding today shows an increase over the beginning of this year, says a statement just issued by Lloyd's Register of Shipping, analyzing the returns from all maritime countries for the quarter ended on March 31. This is due to the gain in orders held by the shipyards of the United States and Great Britain and Ireland, most of the other nations showing a decrease from the totals reported three months ago. The United States now ranks fourth among the nations of the world in ship construction.

The following table shows the comparison in tonnage between the last two quarters, the figures representing gross tons:

	March 31, 1924	Dec. 31, 1923
Great Britain and Ireland.	1,473,629	1,395,181
United States.....	119,767	91,585
Other countries.....	923,108	957,570
World total.....	2,516,504	2,444,336

A feature of the returns is the prominent part that motor vessels are now taking in world shipbuilding. Of this class of ships the total now under way in Great Britain and Ireland aggregates 325,190 gross tons, and in all other countries, 369,522 tons, a world total of 694,712 tons, or nearly 30 per cent of the total for all construction. During the entire year, 1923, motorships launched aggregated only 226,000 tons, and for 1922, the figures was 209,000 tons.

A small gain was also shown in the tankers under construction, the total for this quarter being 183,850 gross tons as against 175,164 gross tons for the previous quarter.

Propeller Club Elects Officers

AT the first annual meeting of the Propeller Club of the Port of New York held March 31 the following executive officers were elected for the ensuing fiscal year by a unanimous vote:

President, W. Z. Gardner; Vice-President, N. S. Tobey; Treasurer, H. W. Parsons; Secretary, H. M. Wick.

The following were elected by a unanimous vote as members of the Board of Governors for a three year term:

E. A. Colson, W. T. Hays, E. M. Hillary, S. A. Daly, J. O. Arkebauer and F. M. Rakestraw.

A board of trustees was also elected by a unanimous vote for the purpose of taking care of what property the club may eventually acquire. The members of the board are:

Charles Hahn, Jr., chairman, R. W. Morrell and E. A. Colson.

Naval Construction Proposed

THE House committee on naval affairs on April 19 favorably reported the bill authorizing the construction for the navy of eight scout cruisers costing $11,000,000 each, rehabilitation of six capital ships of the battle fleet at a cost of $18,360,000, and construction of six river gunboats at $700,000 each.

Complete Bids for Diesel Dredge

FOLLOWING is a complete list of the proposals received on March 15 by James H. Polhemus, general manager and chief engineer of the Port of Portland, Ore., for the construction of a steel hull complete and ready for the installation of machinery for the 30-inch Diesel electric hydraulic pipeline dredge *Clackamas*. Proposal "A" is for furnishing of labor and material, building and delivering the hull, trusses and house complete, as specified; alternate "B", for furnishing, fabricating and delivering f. o. b. wharf, Portland, Ore., all material for hull, trusses and house complete except field rivets and wood material; alternate "C", furnishing all labor for handling, hauling and building hull trusses and house and furnishing all material and labor not furnished by the fabricator under alternate "B".

As announced in this issue of March 29, the contract for the hull has been awarded to the Wallace Equipment Company, of Seattle, Wash., on their bid of $158,000. The complete proposals are as follows:

	Proposal A	Proposal B	Proposal C
Smith & Watson Iron Works, Portland, Ore....	$203,400.00	.....	{ *$68,000.00 † 79,500.00
Wallace Equipment Company, Seattle, Wash....	158,000.00	$129,320.00	.....
The Dravo Contracting Co., Pittsburgh, Pa....	184,500.00	.....	.....
Milwaukee Bridge Company, Milwaukee, Wis...	.....	‡161.00	.....
Ellicott Machine Corp., Portland, Ore.....	265,164.00	.....	.....
Todd Drydock & Const. Co., Tacoma, Wash....	184,500.00	.....	.....
Helser Machine Corp., Portland, Ore.....	.....	.....	46,565.00
Albina Marine Iron Works, Portland, Ore.....	179,750.00	.....	.....
Moore Drydock Company, San Francisco.....	229,300.00	.....	.....
Bethlehem Shipbuilding Corp., San Francisco.	242,345.00	.....	.....
New York Shipbuilding Corp., Camden, N. J....	.....	127,500.00	.....
Sun Shipbuilding & Drydock Co., Chester, Pa...	.....	155,000.00	.....

*According to Sun Shipbuilding Corp.
†According to New York Shipbuilding Corp. ‡Per ton.

BUSINESS NOTES

The S. S. *Biyo Maru*, the only electric driven ship in the Japanese merchant marine, is the sixth vessel of the Toyo Kisen Kaisha to be converted to the Morse fuel oil burning system.

The American Steel Foundries, Chicago, Ill., announce the removal of their offices from the McCormick Building to the 15th, 16th and 17th floors of the Wrigley Building (North Section) 410 North Michigan avenue.

The Merritt, Chapman & Scott Corporation will establish its terminal for wrecking and dredging operations from Los Angeles harbor on a 10-acre tract along the waterfront which was recently purchased at Long Beach, Cal., at a reported price of $250,000.

Following is a list of other recent oil burning installations made by the Morse Dry Dock & Repair Company, of Brooklyn, New York, including five ships of the Toyo Kisen Kaisha: *Monticello, Nickerie, Dorothy Bradford, Alegria, Woyo Maru, Meiyo Maru, Choyo Maru, Hayo Maru* and *Koyo Maru*.

A direct agency has been established by the Dollar Steamship Line in Philadelphia, with offices at 472 Bourse Building. On April 30, the first sailing under the new management was made by the *Margaret Dollar*. George H. Gersen has been appointed commercial agent and William F. Diehl district traffic manager.

On the new German steamship *Columbus*, which has just arrived in New York on her maiden voyage, probably the only equipment furnished from the United States is the Rich system of smoke detection. This apparatus was shipped by Walter Kidde & Company, Inc., New York, more than a year ago, and was installed under the direction of their representative in Hamburg.

Chas. Cory and Son, Inc., of New York, will install the Cory-Aero automatic fire alarm system on the new passenger steamers *Greater Detroit* and *Greater Buffalo*, now under construction by the Detroit Shipbuilding Company, Detroit, Mich., for the Detroit and Cleveland Navigation Company, Detroit, Mich.

The Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., has received the following orders for installations of Bethlehem Dahl fuel oil burning equipment: Two steamers of the Wilmington Steamboat Company, Tampa, Fla.; S. S. *Vulcan*, now being reconditioned by the Federal Shipbuilding Company, Kearny, N. J.; S. S. *La Favorita*, being reconditioned at the Jahncke Dry Docks plant, New Orleans; S. S. *Benjamin B. Odell* of the Central Hudson Navigation Company.

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TRADE PUBLICATIONS

HYDRAULIC DREDGES.—Centrifugal dredging pumps and dredges for various forms of service are illustrated and described in Bulletin F-233 now available on application to the Ellicott Machine Corporation, Baltimore, Md.

ECONOMY IN SHIP REPAIRS.—A booklet telling the story of the facilities, past performance and business policies of the New York Harbor Dry Dock Company, Inc., Staten Island, New York, has been published for distribution to shipowners and operators.

DIESEL OIL ENGINES.—Bulletin 21-S has been prepared by the Lombard Governor Company, Ashland, Mass., to tell of the development of Lombard Diesel oil engines. Complete details with illustrations of engines of various sizes are included with special reference to parts constituting a feature of this type engine.

BENT-TUBE BOILERS.—The Heine Boiler Company, St. Louis, Mo., has issued an attractive bulletin describing the Heine V-type bent-tube boiler. The general design, circulation characteristics, details of construction, supports, trimmings, etc., of this boiler are outlined and illustrated. Details of several installations are also given.

STANDARD MARINE PRACTICE.—The latest issue of the monthly publication of the Standard Motor Construction Company, 172 Whiton street, Jersey City, N. J., contains details of the 1924 Standard marine gasoline engine with various applications of it in tugs and pleasure boats. Other articles are given on the testing department of the Standard plant and of the place the Standard engine holds in the industrial world.

MARINE LIGHT AND POWER PLANT.—A marine light and power plant, consisting of a gasoline or kerosene engine driving a generator charging either 110 or 32-volt batteries and adaptable for service and emergency lighting and power in all classes of self- or non-propelling craft and lighthouses, is described and illustrated in a bulletin sent out by the publicity department of the Westinghouse Electric & Manufacturing Company, New York.

STERN TUBE APPLIANCES.—A method of reducing friction in tail shaft bearings on ships and a consequent saving of power is described in a pamphlet issued by the McNab Company, Bridgeport, Conn., under the title of "Propeller Tail Shafts of Ships." The stern tube appliance is patented in Great Britain and patents are also pending in the United States. Licenses are being granted to shipbuilders to manufacture this McNab-Vickers appliance on a royalty basis.

DIRECT HEAT ELECTRIC FURNACES.—Annealing of castings and wire, heat treating, calorizing, sherardizing and other processes using electric furnaces are shown in a new bulletin, No. 48,721, recently issued by the General Electric Company. The publication is mostly pictorial in content, illustrating the application of this type of heat to various operations in plants of that company. Details as to heat, dimensions and function of each installation shown are given in descriptive captions. The bulletin is entitled: "Direct Heat Electric Furnaces in General Electric Factories."

CENTRIFUGAL COMPRESSORS.—Centrifugal blowers and compressors, and their applications in water gas, coke oven and general industrial plants are described in a catalogue issued by the De Laval Steam Turbine Company, of Trenton, New Jersey. The apparatus includes single stage and multi-stage blowers and compressors for pressures up to 125 pounds per square inch. Besides the description of structural details, the publication contains chapters on blower and compressor characteristics and testing, together with a theoretical and practical treatment of the compression of gases and of the flow of gases through pipes and conduits.

ANCHOR CHAINS.—The story of "Naco" anchor chains is told in a pamphlet published by the National Malleable Castings Company, Cleveland, O. A record of ships equipped with "Naco" chain, of which the National Malleable Castings Company is justly proud includes ships of practically all lines traveling to all quarters of the globe and special mention is made of new construction, a large percentage of which ships are equipped with the products of the National Malleable Steel Castings Company. The qualities of "Naco" anchor chain of strength, shock resistance, uniformity, permanency of shape, resistance to corrosion and wear are outlined in the pamphlet.

TREATMENT OF BOILER WATER.—One of the recent publications of value to the marine engineer is a pamphlet entitled "Treatment of Boiler Water" published by the Babcock & Wilcox Company, describing a new boiler water testing apparatus designed by that company and containing a short but comprehensive treatise on the use of soda in combating corrosion and scale in marine boilers. The new testing apparatus is an enlargement of the well-known Babcock & Wilcox silver nitrate testing outfit which for years has been a standard among the marine men, the addition to the original apparatus being a simple, quickly made and accurate alkalinity test. The information on the treatment of boiler water is of decided interest to the engineer and equally valuable to the owner who pays the repair bills consequent upon damages due to corrosion. A wide distribution of this pamphlet has been made by the Marine Service Department of the Babcock & Wilcox Company, 85 Liberty street, New York, with the hope that the information will prove of assistance to the operators of any and all types of marine boilers.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
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Society of Naval Architects and Marine Engineers
29 West 39th Street, New York
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National Association of Engine and Boat Manufacturers
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Naval Academy, Annapolis, Md.
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11 Moore St., New York.
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National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 11 St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 202 Kendrick Quincy, Mass.

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
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149 Broadway, New York
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21 Pearl St., New York City
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15 Whitehall St., New York City
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Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne

Institute of Marine Engineers, Incorporated
85/88 The Minories, London, E.1.

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Collegio Degli Ingegneri Navale Meccanici in Italia

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